THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XX. No. 478—23RD YEAR.] LONDON, JANUARY 31, 1871. [Subscription { 15s. in Advance. / 18s. Credit. per Annum.] Price 8d. Unstamped.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—10,000 cubic feet of gas per ton of coal; 26-candle gas; 13½ cwt. coke per ton of coal.

RAMSAY'S PATENT CONDENSED COKE.

DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.

GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.

Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubit Town. Large stocks kept.

Address G. H. RAMSAY, NEWCASTLE-ON-TYNE.

GEORGE GLOVER & CO.,

Patentees of the Standard Gasometers for the Government, and of the

IMPROVED DRY GAS-METERS.

These Meters are warranted to measure correctly and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured.

To meet the increasing demand, G. GLOVER AND CO. have just entered on possession of extensive premises adjoining their present Works in Ranelagh Road, and they are now prepared to execute promptly, orders to any extent. They keep in stock all sizes of Meters up to 200 lights. In cases of haste, on the receipt of a telegram early on one day, their Meters can be delivered next day in any part of England, and in the large towns in Scotland.

Particulars and lists of prices forwarded on application to—

RANELAGH ROAD, PIMLICO, LONDON, S.W.;

236, GEORGE STREET, GLASGOW;

OR

15, MARKET STREET, MANCHESTER.

COWEN'S PATENT FIRE-CLAY RETORTS.

JOSEPH COWEN and CO.,

BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,

Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."

J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.

COWEN'S GARESFIELD COALS.

Coal Office,

QUAY SIDE, NEWCASTLE-ON-TYNE.

FIRST PRIZE IN THE PARIS EXHIBITION.

JOHN RUSSELL and CO.,

THE OLD TUBE-WORKS,

CHURCH HILL, WEDNESBURY;

ALMA WORKS,

WALSALL, STAFFORDSHIRE;

and 69, UPPER THAMES STREET, LONDON,

Original Manufacturers of Wrought-Iron Gas-Tubes, and Holders of the present Patents; Inventors and First Makers of LAP-WELDED FLUES for Steam-Boilers.

J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest orders may be executed in a few days.

Gun Metal, and all other kinds of Cocks, Stocks, Dies, and Taps, Galvanized Tubes, &c.

N.B.—All goods thoroughly tested before sent out, and warranted.

JOHN BENT & SON,

WET AND DRY GAS-METER

AND

STREET-LAMP

MANUFACTURERS,

BELL BARN ROAD, BIRMINGHAM.

ESTABLISHED 1830.

All materials found for the alteration of Public Lamps for lighting with the Rod. Regulators with Lava Burners.

BLAYDON BURN AND LOW BENWELL FIRE-CLAY RETORT AND FIRE-BRICK WORKS,

NEAR NEWCASTLE-ON-TYNE.

WILLIAM COCHRAN CARR begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other articles in Fire-Clay, executed on the shortest notice, and on the most reasonable terms.

London Agents: JAMES LAWRIE & CO.,

63, OLD BROAD STREET, CITY, LONDON.

CANNEL COAL FACTORS.

J. & W. ROMANS, of Edinburgh and London, in returning thanks for the confidence hitherto reposed in them, beg to intimate that they have extended their Colliery connexion for the supply of SCOTTISH CANNELS, and have taken a lease of the CROWN WHARF, LIMEHOUSE CUT, LONDON, where these rich Coals can be obtained at the lowest prices.

Messrs. ROMANS, being lessees of several Gas-Works in Scotland, have their Cannels tested in the ordinary working-process-way of gas-making, thus securing for their customers additional guarantee, beyond mere laboratory experiments.

Contracts made to supply any quantity, and analysis sent, on application to the Offices, 53, Frederick Street, EDINBURGH, or 1, Walbrook, Mansion House, LONDON.

Shippers of steam and house Coal, entered on the Government list. Freightage secured on best terms.

LESMAHAGO GAS COAL,

AUCHINHEATH COLLIERY,

LESMAHAGO N.B.

JAMES FERGUSON & CO.

LESSEES SINCE 1832.

LONDON AGENTS:

JAMES LAWRIE & CO.,

63, OLD BROAD STREET, E.C.

CONTINENTAL AGENTS:

LA COUR & WATSON,

LEITH.

GEORGE GLOVER AND CO.,

Patentees of the Standard Gasometers for the Government,

TWO MEDALS,

LONDON, 1862.

HAVE OBTAINED THE

HIGHEST

PRIZE

FOR

SILVER MEDAL,

PARIS, 1867.

IMPROVED DRY GAS-METERS AND GASOMETERS,

AT THE

PARIS EXHIBITION.

RANELAGH WORKS, RANELAGH ROAD, PIMLICO, LONDON, S.W.;

AND 127, BOULEVARD DE MAGENTA, PARIS.

HENRY HOWARD & CO.,

COOMBS WOOD PATENT TUBE-WORKS,

OLD HILL, near DUDLEY,

MANUFACTURERS OF

HOWARD'S PATENT IMPROVED WROUGHT-IRON TUBES,

FOR GAS, STEAM, AND WATER;

Also ORDINARY WELDED WROUGHT-IRON TUBES and FITTINGS,

FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.

CORE BARS FOR IRONFOUNDERS, STOCKS, TAPS, AND DIES, IRON COCKS, &c.

London Agent—W. G. DAVIS, 2, Brabant Court, Philpot Lane, E.C.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS

For Gas, Steam, Water, &c.

SOLE LICENSEES for the United Kingdom for the LAVENANT PATENT ENAMELLED TUBES & FITTINGS,

the Coating of which does not shell off, is a certain preservative from rust, and resists all effects of expansion and contraction.

LAP-WELDED IRON & HOMOGENEOUS METAL TUBES

For Locomotive, Marine, and Stationary Boilers.

Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools of all kinds.

London Offices: No. 4, Cloak Lane, Queen Street, E.C.

WAREHOUSES:

LONDON: No. 157, Upper Thames Street, E.C. LIVERPOOL: No. 63, Paradise Street. MANCHESTER: Barlow's Croft, Chapel Street, Salford. PARIS and LILLE.

ECONOMY IN GAS PURIFICATION. A PURER GAS AT LESS COST, AND GREAT SAVING IN LABOUR.

M'DOUGALLS' PRECIPITATED PEROXIDE OF IRON.

The above Oxide is now in use at some of the largest works in the kingdom, and has gained a decided preference, owing to its efficiency, cheapness, and the great saving in labour effected by its use.

It is a pure artificial Hydrated Peroxide, with an addition of only sufficient sawdust to give it the needful lightness or porosity to prevent pressure, and every particle is available for use.

In selecting an oxide, a point more important than its price, is to learn the cost of labour entailed in its use. Whilst at large works the cost of labour for purifying, where lime alone or the natural oxides are employed, is 2d. to 3d. per ton of coals, by the use of the above Oxide it is reduced to 1d. to 1½d., owing to the purifier's working so much longer when charged, and to rapid revivification—two points of special importance in the busy season.

For export to Foreign Works it is unequalled, every particle being available, and saves freight over less concentrated materials.

NOTE.—It is important to note that only the Hydrated Peroxide of Iron is useful, simple oxide being worthless. Inferior oxides show a large per centage of simple oxide, but very little Hydrated Peroxide.

M'DOUGALL BROTHERS,

LONDON—158, LEADENHALL STREET, E.C. MANCHESTER—68, PORT STREET.

E. J. & J. PEARSON,

DELPH & TINTAM ABBEY FIRE-CLAY & BRICK WORKS,

STOURBRIDGE,

PROPRIETORS OF

BEST GLASS-HOUSE POT & CRUCIBLE CLAY;

MANUFACTURERS OF

GLASS-HOUSE POTS, CRUCIBLES, GAS-RETORTS, & FIRE-BRICKS OF EVERY DESCRIPTION.

TRADE MARK.

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.;

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM,

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

CAST AND WROUGHT IRON GIRDERS, BRIDGES, AND ROOFS,

STEAM-ENGINE BOILERS, & GENERAL WROUGHT-IRON WORK.

London Agents: PORTER and LANE, 172, FENCHURCH STREET, E.C.

D. BRUCE PEEBLES & CO.,

ENGINEERS, WET AND DRY GAS-METER MANUFACTURERS,

BRASSFOUNDERS, & GAS APPARATUS MANUFACTURERS,

FOUNTAINBRIDGE WORKS, EDINBURGH.

SOLE MANUFACTURERS OF

Peebles' Patent Wet and Dry Gas-Meters in Tin-Plate Cases, with Tongue and Groove Joints.

IMPROVED WET METERS IN CAST-IRON CASES.

STATION-METERS, GOVERNORS, EXPERIMENTING METERS, PHOTOMETERS, PRESSURE-GAUGES, &c.

WILLIAM INGHAM AND SONS,

WORTLEY FIRE-BRICK AND RETORT WORKS,

Near

Leeds.

W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of

RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY

beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.

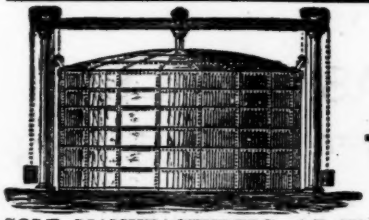
The Works are of such magnitude as to ensure the prompt execution of orders to any extent.

Estimates for Setting, or Bricklayers sent when required.

GAS OVENS IN SEGMENTS OF EQUAL QUALITY.

A large Stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all Sizes kept in London at Mr. ALFRED WILLIAMS, Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.

N.B.—*Export orders continue to have prompt attention.*



IMPROVED GAS APPARATUS,

FOR CITIES, TOWNS, VILLAGES, &c.,

INVENTED AND MANUFACTURED BY

W. C. HOLMES & CO.,

WHITESTONE IRON-WORKS, HUDDERSFIELD.

SOLE MANUFACTURERS of B. W. THURSTON'S IMPROVED SCRUBBER, CONDENSER, and WASHER, in use in many of the principal Gas-Works on the Continent.

PATENTEES of the IMPROVED COMBINED PURIFYING APPARATUS, so eminently adapted for Exportation.

ESTIMATES, PLANS, and SPECIFICATIONS PREPARED for BUILDINGS and APPARATUS.

Prospectus, Price Lists, &c., on application.

LONDON OFFICES—57, GRACECHURCH STREET, CITY.

*** *Please address letters to Huddersfield.*

REFERENCES TO NEARLY 300 GAS-WORKS.

JOHN HALL & CO.,

STOURBRIDGE,

MANUFACTURERS of FIRE-BRICKS, LUMPS, & TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS,

And all kinds of Experimental Gas Apparatus.

FULLERTON, SON, & CO.,

LONDON ROAD METER-WORKS, EDINBURGH,

SOLE MANUFACTURERS OF

THE PATENT IMPROVED TIN-PLATE DRY GAS-METER,

WITH SPECIAL FACILITIES FOR ADJUSTMENT AND REPAIR,

The principal parts of the mechanism being accessible by the removal of a single Screw.

GAS-METERS on the WET and DRY principles made in CAST-IRON and TIN-PLATE CASES.

STATION-METERS, GOVERNORS, EXPERIMENTAL & TEST METERS, GAS APPARATUS, &c.

LONDON AGENTS: THORNELOE & CO., 34, LONDON WALL, CITY, E.C.,

GAS & WATER ENGINEERS, & CONTRACTORS

FOR GAS & WATER WORKS APPARATUS.

SHOW-ROOMS AND WHOLESALE WAREHOUSE FOR

Wrought-Iron Tubes and Fittings for Gas, Water, and Steam; Chandeliers, Pendants, Lamps and Brackets; Plumbers Work, Water-Closets, Pumps, &c.; Lead, Composition, Brass, and Copper Tubes.

METERS SUPPLIED TO ORDER FROM STOCK.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

Analyses by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

Description.	Cubic Feet of Gas per Ton of Coals.	Illuminating Power in Candles.	Coke per Ton of Coal used. Cwt.	Ash in Coke per Cent.	Sulphur in Coal per Cent.
Best Silkstone . .	10,900	17·0	12·8	2·6	1·7
Norfolk Silkstone . .	11,000	15·94	12·5	4·4	1·64
Silkstone Brights . .	11,500	14·5	12·6	7·4	1·85
Silkstone Nuts . .	10,800	15·85	12·66	6·0	0·69

NOTE.—The illuminating power of the Gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

OFFICES, 34. LONDON WALL, CITY, E.C.

TANGYE BROTHERS & HOLMAN,

10, LAURENCE POUNTNEY LANE, LONDON, E.C.;

And BIRMINGHAM (TANGYE BROS.), CORNWALL WORKS, SOHO.

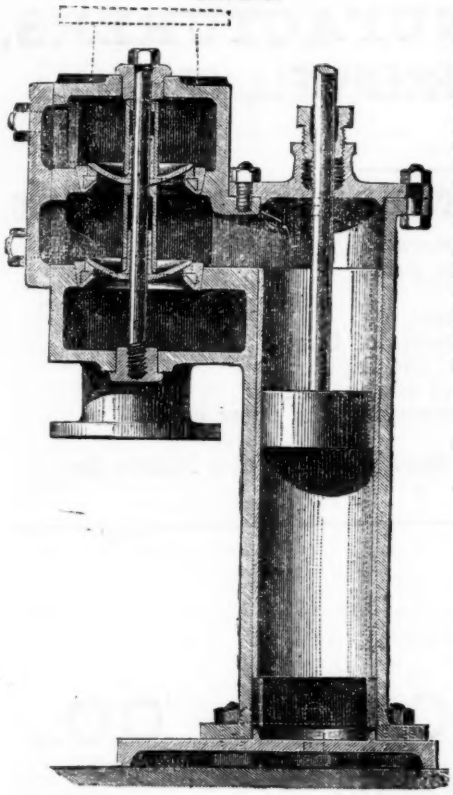
HOLMAN'S PATENT DOUBLE-ACTION VERTICAL PUMPS.

These Pumps deliver a continuous stream equal to the area and traverse of the piston; the piston is solid and has no valve in it like an ordinary pump-bucket, but each side—*i.e.*, the top and bottom sides of the piston, communicate with two pairs of valves, each side having its suction and delivery valve, which act alternately with the up and down movement of the rod; the water passages are so arranged that the whole of the valves are placed in one valve-box, and by the removal of a single plate, access is permitted to the whole of the valves simultaneously. These Pumps are fitted throughout in a substantial and workmanlike manner, and are adapted for all ordinary and extraordinary purposes of pumping. They effect great economy in first cost, space, wear and tear, and are fast superseding the costly and complicated three-throw Pumps, with their cumbrous detail of cranks, strap-heads, slings, guides, stuffing-boxes, and a host of screws, cotters, covers, and doors.

Since the introduction of these Pumps they have been further improved by the application of

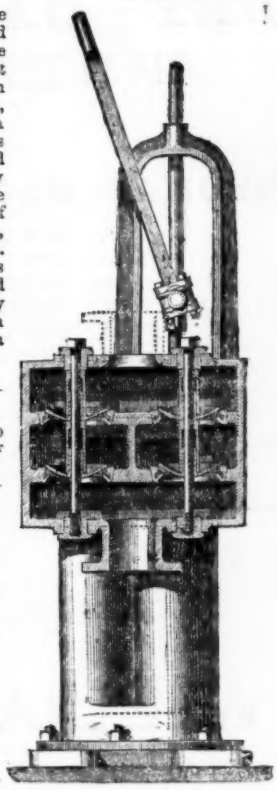
HOLMAN'S NEW PATENT BUFFER VALVES & SEATS,

No. 210.



Which have been designed with a view to obtain an increase of speed with comparatively little noise or concussion, and thereby to increase the relative duty of the Pumps. These Valves have recently been applied with the greatest success to the "Special" Steam Pump, which can be run at 100 strokes per minute with considerably less noise, concussion, and wear in the Valves than takes place with those of an ordinary Pump, running at only 30 strokes per minute. In these Valves the usual centre seat and grating, peculiar to disc Valves in general, are entirely done away with, so that when the Valve is open a free and unobstructed course presents itself for the passing of any large substances that would choke an ordinary Valve, and cause delay and loss by the stopping of the Pump. Holman's Patent Valves are suitable for boiling hot as well as cold fluids, of various properties and densities, and they are so constructed that new seats (which are the only wearing parts) can be applied by any unskilled person in a few minutes, rendering the whole equal to new at a comparatively trifling cost.

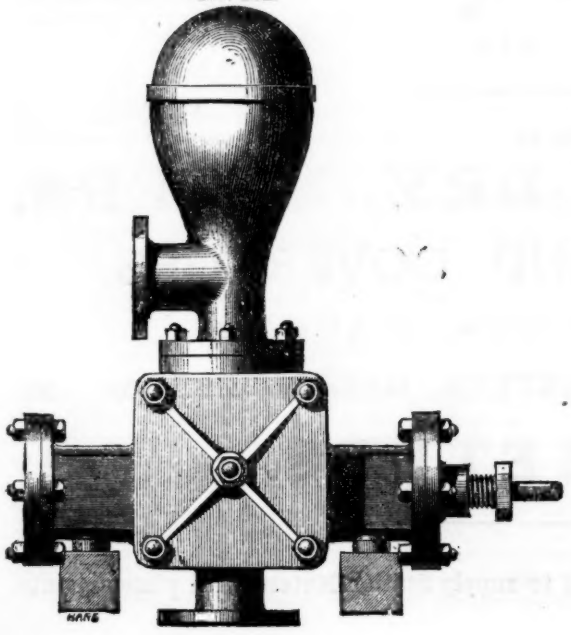
No. 211.



Diameter of Barrel.	Length of Stroke.	Iron Barrel finishing at Rod, as No. 210.	Brass Internal Barrel finishing at Rod, as No. 210.	With Slings, Guide & Standard as No. 211 extra.		Gals. per Hour at 40 strokes per Minute.
3 in.	10 in.	£11 10s.	£13 0s.	£1 5s.	Without Brasses.	1,000
4 ,,	10 ,,	12 10	14 0	1 5		2,000
4 ,,	12 ,,	14 0	16 10	1 10		2,500
4½ ,,	10 ,,	15 10	17 10	1 10		2,500
4½ ,,	12 ,,	16 10	18 0	1 15		3,000
5 ,,	12 ,,	19 10	23 0	1 15		3,300
5 ,,	15 ,,	21 10	24 0	1 15		4,000
6 ,,	12 ,,	22 0	25 15	3 0	With Brasses.	5,800
6 ,,	18 ,,	26 0	30 0	3 15		8,500
8 ,,	15 ,,	30 0	34 10	4 10		12,000
8 ,,	18 ,,	35 0	40 0	5 0		14,000
8 ,,	24 ,,	40 0	45 10	5 15		18,000
9 ,,	18 ,,	43 0	52 0	6 5		18,000
10 ,,	18 ,,	60 0	70 0	9 0		22,000
12 ,,	24 ,,	80 0	95 0	12 0		40,000

HOLMAN'S PATENT DOUBLE-ACTION HORIZONTAL PUMPS.

No. 212.



Fitted with Holman's (new) Patent Buffer Valves and Seats.

These Pumps (the principle of which is described above) are suited for general purposes, and may be rendered available by Engineers and others for their own use and application. It is very expensive to make a set of patterns for a single Force-Pump, and some simple arrangement that can be generally applied will be of great service to the trade generally. They are fitted with Holman's Patent Buffer Valves and Seats, and have a capacious Air Vessel. All the Valves are readily accessible by the removal of a single door.

These Pumps are made of all sizes, from 3 in. to 12 in. diameter, and with either Iron or Brass internal Barrels. The delivery flange can be shifted to any required angle.

Diameter of Barrel.	Length of Stroke.	Iron Barrel finishing at Rod.	Brass Internal Barrel finishing at Rod.	Gals. per Hour at 40 strokes per Minute.
3 inch.	12 inch.	£12 0s.	£14 0s.	1,350
4 ,,	12 ,,	14 0	16 10	2,500
5 ,,	12 ,,	19 10	23 0	3,300
6 ,,	12 ,,	22 0	25 15	5,800
7 ,,	12 ,,	25 0	29 10	7,500
8 ,,	18 ,,	35 0	42 0	15,000
9 ,,	18 ,,	43 0	52 0	18,000
10 ,,	18 ,,	60 0	70 0	22,000
12 ,,	18 ,,	75 0	90 0	30,000

Solid Brass Pumps, with Copper Air Vessels, extra, according to size.

These Pumps are also supplied fitted for driving by strap from shafting overhead, and are then mounted on cast-iron Bed-plate and fitted with crank-shafts, fly-wheel, and riggers, or gear and rigger, &c.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF

PATENT WET & DRY METERS,

STATION-METERS AND GOVERNORS,

PRESSURE REGISTERS, GAUGES,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c., &c.

WATER METERS.

W. P. & Co. beg to state that they are now prepared to supply Station-Meters with planed joints.

CONTENTS.

Notes upon Passing Events:— PAGE
The City of London Volunteers . . . 71
The Shortcomings of the Corporation of the City of London . . . 71
Reform in the Gold Coinage . . . 71
The Tower Subway . . . 72
The late Sir William Denison . . . 72
The *Val de Travers* Asphalte . . . 72
Bailey Denton on the Sanitary Improvement of Rome and on the Selection of Land for Sewage Irrigation . . . 72

Leading Articles:—
Applications for Provisional Orders under the Gas and Water Facilities Act . . . 73
Notes on the Metropolitan Water Supply . . . 74

Circular to Gas Companies:—
Proposed Amendments of the Sale of Gas Act . . . 75
Award under the Bridgend (Glamorganshire) Gas and Water Act, 1869 . 76
The Applications to the Board of Trade under the Gas and Water Works Facilities Bill . . . 76
Continental War Notes . . . 76
Failure on Standing Orders of the Walsall Improvement Bill . . . 76

Legal Intelligence:—
Court of Chancery—The Grand Junction Canal Company *v.* Thugar and the Tring Local Board of Health . . . 76
Court of Queen's Bench—Forman and Wife *v.* The Corporation of Canterbury . . . 77
Court of Common Pleas—Liverpool United Gas Company *v.* The Overseers of Everton . . . 77
Court of General Assessment Sessions for the Metropolis . . . 77
Clerkenwell Police Court—Conviction for Disconnecting a Meter . . . 78

Miscellaneous News:—
Metropolitan Board of Works and the Sewage Question . . . 78
The Farmer Theorem of Gas-Burners—Note by B. Silliman on Mr. Stimpson's Paper . . . 78
Lecture on Light, by A. H. Wood . . . 79
Society of Arts, Adelphi—A. M. Silber on a Method of Lighting by Means of Vegetable or Mineral Oils . . . 79
Professor Tyndall on the Water Supply of London . . . 84
Dr. Whitmore's Report on the Quality of the Gas supplied in St. Marylebone, in December, 1870 . . . 85
Dr. Whitmore's Report on the Quality of the Water supplied in St. Marylebone, in December, 1870 . . . 85
Gas-Works in the War . . . 85
Analyses of the Loch Turret Water . . . 85
Drainage of Oxford . . . 85

Register of New Patents:—
Johnson, J. H.—Production of Oxygen Gas . . . 85
Heath, W. E.—Gas Pressure-Governors . . . 85
Leopard, J.—Treating Sewage . . . 86
Hills, F. C.—Manufacture of Gas . . . 86
Leachman, W. B.—Raising and Forcing Water . . . 87
Mann, J. R.—Water-Closets . . . 87
Applications for Letters Patent . . . 87
Grants of Provisional Protection . . . 87
Invention protected for Six Months . . . 87
Notices to Proceed . . . 87
Patents which have become void . . . 87

Share List of Metropolitan Gas Companies . . . 87
Price Current . . . 88

NOTICE TO SUBSCRIBERS.

The subscription is 15s. per annum if paid in advance during the month of January, or 18s. credit, in two sums of 9s. each, payable in July and January of each year.

Subscribers who have not paid their subscriptions for the year 1870, or or any previous years, are requested to remit the same forthwith to the publisher, in order to prevent any interruption in the regular delivery of the JOURNAL.

The JOURNAL has been duly registered at the General Post-Office for transmission abroad.

All communications for the Editor should be addressed "No. 42, Parliament Street, London, S.W."

Remittances for subscriptions and orders for advertisements should be addressed to the publisher, William B. King, 11, Bolt Court, Fleet Street, London, E.C.

SCALE OF CHARGES FOR ADVERTISEMENTS.

Six lines and under . . . . . 3s. 0d.

Sixpence per line for every line additional.

Special contract for advertisements intended for continuous insertion.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 31, 1871.

Notes upon Passing Events.

IN these war times, war subjects naturally take the first place in our "Notes." The volunteers of the City of London are before the public as suitors for a fund of £20,000. They require it for a rifle-range, a drill-ground, and head-quarters. They are entitled to this voluntary tax from the very numerous individuals who in no other way contribute to the maintenance of volunteer forces. The *Times* significantly reminds us that the metropolis—which is London to all foreigners—contains three millions and a quarter of inhabitants, "twice the population of Denmark, and more than "the population of Switzerland, which can put two hundred "thousand soldiers in the field;" so that there is nothing to be especially proud of in the number of our London volunteers. The voluntary principle has the same strength and the same weakness when applied, in England, to national defence as to charity. Companies and regiments are raised by the individual zeal, and partly at the cost of officers. Without this zeal and expenditure, the volunteer army would never have existed at all. Now that we are beginning to look at military organization, by the light of the German War, as a serious thing, we find that we have too many head-quarters, too many officers, too many separate drill-grounds—in a word, too expensive machinery for the result. The difficulty is to economize by amalgamation without injuring the recruiting power of individualism. It is pretty generally admitted that if the national defences are to be placed on a sound—that is, an efficient—basis, militia, volunteers, and even the regular army must be harmonized and worked together. At present, the head-quarters of the regular army in the City are in the Tower; of the militia, in Finsbury Square; where, too, the most ancient body of volunteers, the Honourable Artillery Company, have also their military house and club. Cannot the superior military authorities intervene, and induce these various bodies to put on one side their jealousies, and agree to utilize the space and buildings now very barely occupied by the militia and the successors of the City trainbands? The business department of each regiment must be separate, but many expenses are "*clubable*." As to rifle-ranges, the completion of the railway communications of the metropolis ought to make two ranges accessible to all the volunteers of London. There was a very good open-air drill-ground wasted, in deference to sectarian prejudices, when Bunhill Fields was surrendered by the Ecclesiastical Commissioners. The space is now encumbered by a multitude of gravestones and projecting vaults, which do *not* commemorate very obscure individuals. Considering the number of churchyards that have been utterly demolished to make room for metropolitan streets and railway improvements, there could be no reason why Bunhill Fields should not have been levelled and thrown open for recreation. The memory of the few really great men whose dust it contains, and the names of any recent interments who had relatives to care for them, might properly and effectively have been preserved by mural tablets or in a mortuary chapel. Pending better things, we doubt not that the City will find the £20,000 so urgently required to preserve the vitality of the City volunteers.

When the *Times* sounds the clarion notes of attack, we may depend on it that some serious measure is in preparation. The *Times* has not always been successful in its onslaughts, but in a general way it has scented out not only the battle but the victory. The attack on the Corporation of London for their negligence in the disposal of waste lands, on which Mr. Isaacs's committee is now sitting, is ominous of parliamentary action. That the site of Fleet Prison, "and all the parts that there adjacent lie," should have been vacant for twenty years, shows plainly that there is no department in the Common Council official establishment interested in increasing the City revenues. When a banquet, a ball, or anything that involves feeding and spending, is in the wind, the enthusiasm is delightful; but as to making money, that is not the business of the Chamberlain, or the Architect, or any other of the dignified or undignified titled or untitled officials. The Corporation of London is very strong in Parliament, but not strong enough to resist public opinion. The *Times* sees, no doubt, that it would be a popular thing for any administration to reconstruct the Corporation; hence this complaining and threatening. The Corporation, like the defenders of rotten boroughs in 1830, declares that it does its business extremely well, in spite of the anomalies of its constitution. But the outside public join issue on this point, and, with many examples of shortcomings, call for the reform, not the destruction of this ancient institution. We note that even in the time of Charles II., after the Great Fire, according to garrulous Samuel Pepys, the churches which so astonish in the City by their number, were built in groups, not for the accommodation of congregations, but to afford patronage to "the King, the Lord Chancellor, and the Corporation!"

It was one of Sydney Smith's jokes that Lord Melbourne, while affecting to know nothing, and care for nothing, was capable of sitting up all night to study the mysteries of soap-boiling, in order to meet a deputation of tallow chandlers the next day, and astonish them by his acquaintance with the details of their greasy trade. The Chancellor of the Exchequer has more than once disclaimed any pretensions to art-knowledge; but it seems that one of his first steps in his new duties, as Master of the Mint, is to reform the gold coinage—to revive St. George and the Dragon, the handsomest of our sovereigns. Critics have called on him to go farther, and give the subjects of new institutions a portrait of our widowed middle-aged Queen. It will be remembered that Mr. Disraeli's Tadpole proposed as a cry, "Our young Queen and our old institutions!" That was a quarter of a century ago. Her Majesty, unlike her friend, a once beautiful duchess, is

conscious that she is no longer young, for she permits photographers to take their unflattering portraits.

The Tower Subway is one of the modern conveniences added to London. Completed without any fuss or public assistance—unlike the departed Thames Tunnel—it is a marvel of cheapness. But many jokes will be passed at the expense of the able engineer, since it has been found that the ingenious steam-worked omnibus—which cost so much thought, exhausted so much inventive power, not to mention money—is not required. The passengers prefer paying a halfpenny and walking, to paying a penny and riding. This is almost as good as the fate of the clever contrivances for making a locomotive wheel stick to a rail, before George Stephenson discovered that no artificial adhesion was required.

Sir William Denison, who died the other day, was one of the first officers of the Royal Engineers appointed to govern a colony, when it began to be the custom to select governors for their education and ability, as well as because they were "somebody's "cousin." Tasmania owed Sir William Denison some very useful public works, and his writings contain many useful suggestions as regards New South Wales and Madras, which he successively governed. His last employment was as Commissioner on the Purification of Rivers.

The *Val de Travers* asphalte is making wonderful conquests in the City of London. Seldom has any innovation given satisfaction so universal. The Bank of England, and other banks, hospitals, and great mercantile establishments, are all suitors to the street authorities for this clean and noiseless pavement. One difficulty—the eternal difficulty—What is to pay the cost?—alone defers the replacement of granite by bitumen in every City street of crowded traffic. Meantime, following the good example of Islington, the steam-roller has travelled as far as Regent Street; and we safely prophesy that the shopkeepers in that fashionable thoroughfare will never go back to the barbarous system of rolling down a macadamized road with spring carriages and blood horses. As well go back to stage coaches and broad-wheeled waggons and pack-horses on our highways.

The truly indefatigable Bailey Denton is in the newspapers, with a short letter suggesting a commission of inquiry into the possibility of making Rome healthy and sweet-smelling, and even taking in hand the gigantic task of carrying main drainage, deep drainage, steam pumping, and steam deep cultivation into the pestiferous Campagna. He justly observes that Italy has engineers who are men of genius, as proved in that triumph—the Mont Cenis tunnel. Splendid and sensational as that great work is, it is not so important to the future of Italy as the reclamation of those millions of rich waste acres which are now water logged. Unfortunately, the personal difficulties in the way of introducing modern engineering and agricultural arts into Italy are greater than the physical difficulties. An officially educated class of Italian engineers, versed in every kind of elegant and useless knowledge, look with the greatest contempt on the coarse barbarians of the north who invented and use the steam-engine for so many purposes, and cut and carve iron implements as easily as a Parmesan cheese. The Italians understand perfectly the science of irrigation, as applied by natural channels in its most unwholesome shape, but of the effect of thorough drainage, and the power of artifically pumping by steam or even by wind power, they know nothing. It is to be hoped that the present Government of United Italy will have strength enough—they have sense enough—to consult and employ experienced engineers trained in the best school. When we think of the wonderful mixture of experience, pertinacity, tact, engineering knowledge, and financial power concentrated in the late Thomas Brassey, and what he would have done with this latest phase of "the Roman Question," we are inclined to cry—

Oh, for one hour of blind old Dandolo!

Though, to be sure, any one less blind than Thomas Brassey it would be impossible to conceive. Mr. Denton has also done good service by printing a paper, "On the Selection of Land for "Sewage Irrigation," full of useful facts, which he read at Maidstone last year. The great point of this paper is to combat the notion that sewage can only be usefully applied to sandy porous soils. Mr. Denton maintains, and gives evidence for his theory, that a fertile loamy clay, artificially drained and otherwise properly prepared, will yield better results than poor porous land, and that even stiff clay may be fitted to receive sewage irrigation; but he must speak for himself, in the following selected extracts:—

The quantity of land required for sewage irrigation, per 100 or per 1000 people, will depend on several considerations—first, the character of the land; next, the extent to which (by natural or artificial drainage) filtration can be resorted to in connexion with irrigation; and last, the amount of dilution to which the sewage is subject. Upon the last point I have already said all that is necessary, and as the first and second points demand special attention on several grounds of economy, and I shall, therefore, treat them somewhat lengthily, I will at once state that as far as experience has gone, the quantity of land required will vary from the minimum of one acre to every 100 persons to the maximum of one acre to every 50 persons. With free soils, and a full recognition of the advantages of filtration in connexion with irrigation, one acre may suffice to cleanse the sewage from 150 persons, and under the same condition one acre of what are called retentive soils may equally suffice to cleanse the sewage of 100 persons. But these quantities must be enlarged for two reasons—first, because provision must be made for increasing population; and next, because it is most desirable to have a margin of extra land beyond that which is absolutely required for purification, in order to allow of an alternation of cropping and an occasional rest of the land from sewage. Again, if the sewage is diluted above the standard I have mentioned, as it frequently will be, the farmer will desire to spread it over as wide an area as he can, and he should be provided with land to enable him to do so. If filtration is resorted to at times as a separate process (irrespective of irrigation), the area required may be reduced considerably. . . . Gravel and sands may be so porous and open that the sewage may pass through them without that cleansing which propor filtration secures; a considerable portion of clay should exist in all irrigated lands; all soils, whether clays or sands, should be naturally or artificially drained, but not so as to let the sewage into the drains without being previously filtered; and instead of "flooding" and "drowning" land, in imitation of Wiltshire water irrigation, the sewage should be as carefully and economically applied as practice will allow. With care, no more of the liquid need be seen on the surface than is sufficient to spread itself over the whole of the space it is intended to serve, and to completely saturate the soil and subsoil beneath. . . . Irrigation on the "flooding" and "drowning" principle may become very unhealthy wherever it is practised, and that it rightly deserves the character given to it by Mr. Thomas Hawksley, who, on a recent occasion, declared that it turned land into bogs and marshes. But, while making this admission, I am equally prepared to assert that where irrigation is properly practised in connexion with intermittent downward filtration the very reverse occurs. . . . If, instead of wasting sewage by "flooding," the land is so prepared that the whole surface receives and absorbs the quantity given to it, all objection ceases. The sewage farm does not then become a bog or a marsh, but as the liquid descends through the soil to the drains, the land becomes sound to the tread, and healthful in every respect. Then the evaporation of water and the evolution of gases are reduced to a harmless amount, resulting in a total absence from smell from the land itself as soon as the sewage has disappeared. I hope I make the difference between the two treatments clear to you, for success depends upon its recognition. It is quite true that grasses form a network of roots at the surface, which seem to luxuriate in the advantages of an "airing," but it is nevertheless the fact that the sewage, when conveyed to the roots of plants within the soil, is delivered in a manner and quantity most suitable for assimilation. I will not insult you, as agriculturists, with any argument to prove that it is our duty to aërate the soil as deeply as possible by drainage, and to increase the feeding-ground of vegetation as much as possible thereby. We are now finding that we must look to the soil to take its turn, not only in the process of purification, but in the storeage of manurial matter, which vegetation cannot always appropriate; and it is inevitable that, at no very distant period, sewage farms will be considered incomplete if special provision is not made for the application of the sewage to fallow land during those periods of rest and abstinence to which all vegetation is subject. This will be done by preparing the whole of the sewage farm for the proper absorption of the sewage, recognizing practically thereby the value of "intermittent" filtration. . . . Clays are known to have the power of retaining fertilizing substances in a much greater degree than sands and gravels, although the powers of absorption in the latter may be greater. It is for these reasons that I consider loamy soils, in which clay forms a part, are those which, if properly treated by drainage and deep surface cultivation, are capable of becoming better filters than sandy and gravelly soils, which are not susceptible of the same amount of disintegration by the action of the atmosphere. I do not mean to say that I should select the stiffest clays for irrigation, but I have no hesitation in declaring that, with the two conditions I have named, clayey loams are those we should select; and that, in point of fact, it is much more likely that land may be too porous than too stiff. I should not utter these opinions, which may sound very much like mere assertions, were I not able to support them by positive proof. . . . Dr. Voelcker, whose opinions as an agricultural chemist we all prize, has declared that he preferred the "better soils for the reception of sewage to poor land, because on the better description the benefits would be greater than on poor land, always provided that they were of a proper depth, and sufficiently drained to let the water pass through the soil. It was more a question of the division of the particles of soil." On another occasion he said, "when clay soils were properly subsoiled and drained, so that the water could freely percolate as through a sandy soil, they were better adapted for the reception of the sewage than the latter, and the crops, generally speaking, would be better. The reason was simple: in clay soils were found a greater abundance of mineral matters which plants keep as food."

On porous soils, a good deal of the fertilizing power of sewage is wasted. This is important where profit is the object; where a town only desires to be rid of a nuisance, it may be an advantage. As to the mode of profitable application, that recommended by Mr. Chadwick in thousands of Blue-Books is completely exploded amongst all men of science and experience:—

The only mode of irrigation now generally acknowledged to be appropriate is that which distributes the sewage on the surface. The plan, however, adopted by Lord Essex, Mr. Mechi, and some few others, of showering the sewage by hose and jet (which is one mode of surface irrigation) is now objected to for three reasons, the first being that the expense is much greater; the second that it is difficult to apply the sewage in sufficient quantities to saturate the soil, while the service is attended with a loss by evaporation; and the next that it covers the stalks and surfaces of the vegetation with clinging sewage, which has been made a good deal of in consequence of its having been said—though without proof—that parasitic diseases are communicated by the deposit of sewage on plants consumed by cattle. The suggestions that have been made from time to time for subterranean irrigation, on the ground that the sewage may thus be taken direct to the roots of plants, to rise up in the soil and saturate it to the surface, have been entirely discarded. A remark made by the late Lord Palmerston on the occasion I have referred to, when, to meet the objections of his tenants who demurred to the loss of their water meadows, it was proposed that the under-drains should be occasionally stopped up, and water let into them from the river Test, explains the ground of objection. On consulting his lordship whether I should try the experiment, he stated, "You may do so to a very limited extent, and at my cost, but it is opposed to a ruling principle of cultivation. Every good gardener has now rejected the saucer to the flower-pot, because he will not have bottom water. He prefers supplying his plants with water from above, taking care that there is proper drainage below." I need not tell you the experiment was never tried.

The last section of the paper is devoted to an account of the crops most profitably grown with sewage. And here we may properly remark that there is no royal road to sewage farming, any more than to any other kind of farming and gardening—a man's whole business is not to be made profitable by an unlimited supply of

sewage manure, any more than by a cargo of guano, in ignorant hands. Italian rye-grass, on which so much has been written, is not always profitable as a selling crop; where there is consumption—as for dairy cows—on the farm, it pays well. The chemists value sewage at 1d. a ton, but, at that price, a ton of grass might cost £1 6s., and that would be too dear for the real farmer. Excellent profits have been obtained from the growth of mangolds—which can be transplanted with sewage in the driest seasons—from beetroot, white kitchen turnips, from carrots and parsnips. Where the soil is deep and well stirred, from £30 to £50 an acre has been realized. Where a market exists for early potatoes, *with good management* they may pay; but of all crops, where there is a market, cabbage is the most successful, particularly where the soil has a mixture of clay:—

At the Lodge Farm, 3a. 0r. 30p. of Collards were planted at the end of June. This yield was ready for market in three months, and realized £232 17s., or £72 an acre, the quantity of sewage applied being 2368 tons per acre. Savoys have realized £40 an acre, with rather more sewage than in the case of the Collards. I have in each case given you the quantities of sewage applied at Lodge Farm, where the soil is very porous, and where the sewage is, therefore, partly wasted. With soil in which clay exists much less will suffice, as I have already explained. Mr. Petre speaks of an advantage in the use of sewage, which is of a special character—viz., its effect in destroying the louse. He says: "A piece was planted with red cabbage in November, and although the crop was much injured by the louse, and the stock was so bad as to render at least two-thirds of the plants valueless, it nevertheless yielded, by the middle of August, upwards of £25. The crop was sewaged five times, and I observed that the sewage had a strong effect in destroying the louse and recovering the plant weakened by its attacks." I have already run through my list of what I call the farmers vegetable crops. I might add a number of others which have been grown, but I consider they belong more to the market gardener than the farmer, such as onions, which, when well grown, are as profitable as cabbages; green peas, French beans, spinach, cabbages of various sorts sown for "plants," brocoli, celery, lettuce, and endive—not to speak of parsley, strawberries, and other small fry—all of which have been found profitable when the cultivator has known how to treat them. All these latter crops will come into favour, as a matter of course, when the sewage farmer has added to his knowledge some of the necessary details of market gardening. At present it is best to avoid them. With sewage of requisite strength, and water at command in times of drought, the most prolific crops may be secured from all of the various sorts I have named as "farmers vegetables," and very often two crops can be grown in one year, or at least three crops in two years. For instance: winter cabbages or early potatoes for spring sale may be succeeded by mangold wurtzel, red beet, sugar beet, parsnips, or carrots. In some cases the succeeding crop may be sown or planted between the rows of the retiring crop. Both arrangements are made facile with a command of diluted sewage, and I heard, on more than one occasion during the recent drought, market gardeners express their astonishment at the difference of growth obtained by sewage compared with that of their own lands, which they were loading with horse-dung at a cost of from £6 to £8 an acre, according to the cost of carriage. Mr. Petre says: "A plot of exhausted rye-grass, which had been cut four times since January, was ploughed up in July, and sown with white turnips, which will be off the land by November, giving £10 net per acre. It may be said that this succession of crops is attainable without the aid of sewage. No doubt it is, under favourable circumstances of weather, and with a large supply of manure, but the advantage of the sewage lies in the fact that the more unfavourable the weather for the ordinary mode of cultivation, the more certain the results from the use of sewage." The principal reason for avoiding crops which have been hitherto beyond the province of the farmer, is that to realize them it is necessary to expend a very large amount in manual labour. It is the hand and knee weeding of onions, and the picking of peas, Brussels sprouts, and spinach, which run away with money. Moreover, vegetable markets are very fickle, while the expenses are really great, whatever be the price realized. There remain now only two other classes of cropping to which I would draw your attention—cereals and pulse. With the introduction and proper preparation of fallow land, by treating it as a filtering medium, we shall be able to secure in the regular season a variety of heavy crops from those lands that have been sewaged in the winter. The production of straw of all kinds on a sewage farm is a matter of great moment, and it may be conceded that a very large bulk of straw will be grown, even if the grain itself did not yield a proportionate quantity. The value of the straw will not be limited to its selling price, for as we progress we shall find it very advantageous to consume it by stock, with the offal vegetable stuff which cannot be sold, or, if sold, only at a great sacrifice. In some cases, probably, the sewage farmer will be disposed to keep cows for the production of milk for the home or distant markets, in which case straw, both for fodder and litter, will be indispensable. In other cases the feeding of young stock and pigs will be deemed the more safe and economical course, and then the same remark will apply. Moreover, farmyard manure is required for special crops not sewaged, and should be provided. In the main, however, the less the sewage farmer deals with stock and those other branches of farming which are not essential to a sewage farm, the better it will be, for he will require all his attention to be devoted to the essential duties of the farm, and the marketing of its regular produce. I hope, in conclusion, that I have said enough to satisfy you that there is a future for sewage farming. I believe myself, and I should like to hear that you are of opinion, that the sewage farmer may with certainty realize a gross return of £20 an acre, and, with increasing knowledge, as much as £30 an acre; and that he can afford to pay for his farm with its sewage manure from £8 to £10 an acre, free of rates, tithes, and taxes. This would leave him with at least £10 to £12 an acre wherewith to pay labour (steam, horse, and manual), seeds, plants, wear and tear and restoration of implements, and a very handsome return for his capital and industry.

APPLICATIONS FOR PROVISIONAL ORDERS UNDER THE GAS AND WATER FACILITIES ACT.

The *Bideford Gas and Coke Company, Limited*, apply for an order conferring all the customary rights and powers of gas companies for the manufacture and supply of gas, the utilization of products, and the manufacture of and dealing in fittings, &c. Power is asked to purchase two additional acres of land, with the usual provision that storeage works shall not be erected without the permission of owners or occupiers within 300 yards. The price of gas is not to exceed 5s. 6d. per 1000 feet; and public lights are to be charged for at a price not exceeding the lowest price paid by a private consumer. Gas supplied is to have the illuminating power of 14 candles. The company is to maintain a testing-place, and any Local Board within the limits, or person authorized by them, is to have access to the testing-place at all reasonable times in the daytime, after giving three hours' written notice. The penalty proposed for deficiency of illuminating power, or obstruction to the examiner, is £10. Power is sought to issue debenture stock not to exceed £1000, and to attach to this stock a fixed perpetual and preferential interest, not to exceed 5 per cent. The order contains all the usual clauses conferring powers of inspection for the prevention of fraud and waste, and the recovery of rents.

The *Bognor Gaslight and Coke Company, Limited*, apply for an order conferring the most comprehensive powers of manufacture and supply. No borrowing powers are sought. The price of gas within the limits of the Local Board of Bognor is not to exceed 6s., nor 7s. per 1000 feet beyond that district. The illuminating power of the gas is to be 12 candles, tested by Sugg's new "London," or other approved burner. A testing-place is to be maintained by the company, and any five consumers may appoint an examiner; and, in the very improbable contingency that the gas be found of lower than the stipulated power, a fine of £5 may be inflicted. Consumers are to keep meters belonging to or used by them in order, at their own cost. The register of a meter is to be *primâ facie* evidence of the quantity of gas consumed; but it is provided that if a meter become defective, or if the company have reason to believe that the quantity registered is not the quantity actually consumed, the company may charge for and recover in respect of the quantity actually consumed, and if the company and customer differ on this point, two justices are to adjudicate between them. Security for gas-rent may be required by the company, and in case of disagreement between the company and a consumer as to the nature and amount of the security, it is to be referred to a justice, whose decision is to be final and binding; and if the security decided upon be a deposit of money, the company are to pay interest at such a rate and for such a time as the justice may direct. Besides these unusual provisions, the Bill as proposed will give all the customary powers for the prevention of fraud and the recovery of gas-rents.

The *Hawkhurst Gas Company, Limited*—to whom it might almost be said we owe the Gas and Water Facilities Act—apply simply for an order to enable them to maintain and continue their works, to empower them to break up streets, to define the limits of their district, to levy rates, and for other purposes. A draft of the provisional order only is printed, without the Bill proposed.

The *Knutsford Gas and Water Company, Limited*, apply for a provisional order putting in force the Gas and Water Facilities Act, 1870, for the reincorporation of the company, with powers for manufacturing and supplying gas to Knutsford and various adjacent townships in the county of Chester. The original capital of the company is to be £6925, divided into shares of such amount as may allow them to be apportioned among the shareholders. In addition to this, power is sought to raise £13,075 in new £5 shares. The dividend on the original capital is not to exceed 10 per cent., and to 6 per cent. on such new shares as may be issued with a preferential interest. Power is sought to borrow, at any time, £3842 8s. in respect of the original capital, and £1157 12s. in respect of the new, the latter under the usual restrictions. Power is also desired to issue debenture stock, at a maximum rate of 5 per cent. The order makes all the necessary provisions for the reconstitution of the company, and confers all the rights commonly accorded to gas companies. The gas is to be of 14-candle power, and is to be free from sulphuretted hydrogen and ammonia. The maximum price is to be 7s. per 1000 feet. For their gas undertaking the company ask power to hold five acres of land, inclusive of the site of the present works. No provisions for the testing of the gas are proposed.

The *Northampton Gaslight Company* make application for an order to enable them to raise additional capital, and for other purposes. The amount of capital it is desired to raise is £45,000, by the issue of new shares or stock, ordinary or preference, the dividend on which is limited to 7½ per cent. if ordinary, or 6 per cent. if preference. Power is sought to borrow, at any time after the confirmation of the order, £15,000, inclusive of sums already borrowed; and afterwards £12,500 on the usual conditions, as the new capital is subscribed for and paid up. The company also seek power to issue debenture stock, and to purchase land not to exceed four acres in extent, on which no gas is to be made. It is proposed to repeal a portion of the company's Act, 1858, which limits the remuneration of directors and auditors to £300 per annum.

The *North Middlesex Gas Company, Limited*, supplying portions of the parishes of Hendon and Finchley, apply for an order to give them the usual statutory powers for the manufacture and supply of gas, the utilization of products, and the making and dealing in fittings. Gas is only to be made on the site of the present works; but power is sought to purchase two acres additional, with the usual proviso that gas is not to be stored on such land

without the consent in writing of occupiers, &c., within 300 yards. Borrowing power is sought to the extent of £3700, inclusive of a sum of £3580 already borrowed by the company, the capital of which is not stated in this order. The maximum price of gas is not to exceed 5s. per 1000 feet; the quality is not provided for. The Bill, as proposed, provides that every consumer shall keep in order, at his own expense, all meters belonging to or used by him, and makes the usual provisions for the punishment of frauds, and the recovery of rents.

The *Pembroke Docks and Town Gas Company, Limited*, apply for an order to give the statutory powers for the maintenance and regulation of gas-works for the supply of Pembroke Docks and town. The company appears to have been recently formed for the purpose of purchasing the undertaking of the County and General Gas Consumers Company, which is now leased to Mr. G. W. Stevenson. No capital is named, and no borrowing powers are sought. Nor is any mention made of the division of profits, further than it is asked to form a renewal-fund out of profits for the purpose of providing for a renewal of the lease, or purchase of the freehold of the lands whereon the works are situate. The maximum price of gas is to be 6s. 6d., the quality not being guaranteed by the order. All other usual powers exercised by gas companies are asked for.

The *Plymouth and Stonehouse Gaslight and Coke Company* also apply for an order to empower them to raise additional capital to the extent of £50,000, by the issue of new shares, ordinary or preferential. If the latter, the dividend is limited to 6 per cent., and such shares are not to confer any right of voting at the meetings of the company. The dividend on new ordinary shares is limited to 7½ per cent.

The *Staines and Egham District Gas and Coke Company* apply for an order conferring statutory rights and powers. The capital of this company is £11,600, of which £10,100 is paid up. In respect of this, power is asked to borrow £3300. All the usual powers for the manufacture of gas and fittings and the utilization of products are asked for. The Bill will considerably extend the limits of the company. The maximum price of gas within the old limits is to be 5s. 6d., and 7s. per 1000 feet beyond. Gas is to be supplied of 14-candle power, and free from sulphuretted hydrogen. A testing-place is to be maintained by the company, and two justices, on application of five consumers who have paid in the aggregate £25 in the preceding year, may appoint an examiner, who is to have access to the works before 8 p.m. The forfeit proposed for deficiency of illuminating power or impurity is £5. There is nothing else in the proposed measure which calls for notice.

The *Southbank and Normanby Gaslight and Coke Company, Limited*, apply for an order empowering them to maintain and extend their present works, the order specifying the erection of two gasholders, a retort-house, and a depôt for the sale of coals, coke, and lime. The order will give the most comprehensive powers of interference for the laying of pipes and mains. Power is asked to raise £10,000 new capital, with borrowing power to the extent of one-third of that amount. Preferential dividend is limited to 6 per cent. The price of gas is not to exceed 5s. 5d. per 1000 feet, with an allowance of at least the odd 5d. by way of discount if the account be paid within a month of the date of invoice. A particular section saves the rights of manufacture and supply of gas now enjoyed or exercised by Messrs. Bolcklow, Vaughan, and Co., Limited, at their works at Eston

The *Stourbridge Gas Company* apply for an order to extend their limits by including the adjacent village of Hagley and the highways leading thereto. The price of gas in this new district is not to exceed 5s. 6d. per 1000, so long as the annual consumption in the parish of Hagley is under a million feet; above that quantity, and below a million and a half, the price is not to exceed 5s.; and if over the last-named quantity, the maximum price is to be reduced to 4s. 9d. per 1000 feet. The order will give the company power to enter into contracts for public lights in the new district, and will limit the charge for such lights, including the necessary cost of pillars, to £3 5s. per lamp, if lighted for nine months, or £3 15s. if lighted for twelve months in the year.

The *Taunton Gaslight and Coke Company* apply for power to raise £7000 additional capital, by the creation of new £5 shares, the new shareholders to have the same rights and privileges as the old. Power is also sought to borrow £2333 in respect of the new capital, under the usual restrictions, and to issue debenture stock. The order will make a portion of the new capital (£1200) applicable to payment for works recently completed.

The single application for an order to confer statutory rights on a new undertaking is made by the *Birkdale Gas Company, Limited*.

Birkdale is situated within the limits of a radius of six miles from the town-hall, Southport, claimed by the Commissioners of Southport, and has hitherto been supplied by the commissioners under an agreement with the Local Board of Birkdale, which expires on the 30th of September next. The preamble of the order recites that it is desirable to make better provision for the supply of gas to Birkdale. The capital of the company is not stated in the draft order, but power is asked to borrow on mortgage a sum or sums equal to the capital issued and accepted under the usual restrictions. The maximum of price of gas is to be 4s. 6d. per 1000 feet, with a discount of 10 per cent. for prompt payment. The illuminating power is to be 14 candles, tested by a 15-hole Argand, with 7-inch chimney, and the gas is to be free from sulphuretted hydrogen. We may say, shortly, that the order, if obtained, will confer all the customary rights and powers on the company as to manufacture and supply. It appears from the preamble that the mains, pipes, &c., for the supply of the district of Birkdale have been laid down at the expense of the Local Board, and these the company propose to purchase by agreement. The order also provides that the undertaking may be sold to the Local Board within ten years from the confirmation of this order after three months notice from the Board to the company. The terms stipulated for are the payment of the expended capital, and the discharge of existing liabilities of the company, with—if the purchase take place within the first three years—an additional sum to make up dividends of 6 per cent.; and if after the first three years, and during the term of ten years, an additional sum to make 6 per cent. for the three years and 7 for the remaining time, if dividends at the said rates have not been paid out of the profits of the company.

NOTES ON THE METROPOLITAN WATER SUPPLY.

The continual reports of Dr. Frankland on the turbid state of some of the metropolitan waters, and probably the knowledge that the Board of Trade have in preparation a measure for amending the Acts relating to the supply of water to the metropolis, have given rise to an agitation in the southern districts, which has resulted in the appointment of Captain Tyler by the Board of Trade to make an inquiry into the state of the water supplied by the Southwark and Vauxhall Company. The inquiry was opened at Battersea on the 3rd of January, and has been adjourned until milder weather permits an examination of the company's works at Hampton and Battersea. The charge brought against the water is its occasional turbidity, from which it is inferred that the use of the water must be deleterious. It seems hard to believe that a minute quantity of exceedingly fine particles of clay in suspension, which no doubt is the chief cause of the turbidity, can be prejudicial to health; but that such is the fact seems to be the opinion of sundry district medical officers.

In justice to the company, it must be remarked that the charges refer to a period now long past (1868-9), and it is admitted that at present the condition of the water is much more satisfactory. Since Mr. Netten Radcliffe made his report to the Privy Council in July, 1869, the Southwark and Vauxhall Company have completed extensive new works with the result above mentioned. The agitation is, therefore, ill-timed and unnecessary; and the only object probably is to push the Board of Trade to the introduction of some revolutionary measure for the virtual confiscation of the water companies.

The agitation is likely to receive an additional stimulus from the sensational lecture delivered by Dr. Tyndall at the Royal Institution, an abstract of which we publish in another column. Just as, twelve months ago, he frightened his audience by showing that the cloudy appearance seen when a beam of light from the electric lamp is sent through the air, was caused by the presence of solid particles in the atmosphere, so, a fortnight ago, he produced a similar effect on his hearers by exhibiting the opacity rendered visible in water apparently clear when subjected to the same test. The inference was irresistible, that air and water—that is, most waters—are alike pervaded by solid particles, the noxiousness of which was more than insinuated.

We have said most waters, for, in fact, the different London waters showed the opacity in very different degrees. The New River and West Middlesex exhibited the least, the Lambeth and Chelsea the most, while the Kent Company was almost completely transparent. The last-mentioned fact introduced the point of the lecture, which was, that water from the chalk is best fitted for human consumption. Not, however, in its natural state, for it was further shown that, after softening by Clark's process, such water was rendered perfectly transparent. Hence the professor advocated the supply of London with water from the chalk, softened by Clark's process. We may mention, in passing, that the much-vaunted Loch Katrine water showed almost as much opacity as the most turbid Thames water—a fact which will probably give the *coup de grâce* to any scheme for supplying London from a lake district.

Beyond the application of the electric lamp, there is nothing at all novel in Dr. Tyndall's observations. Every one who has been

in the habit of observing waters through a two-foot tube is well acquainted with the varying colour and turbidity of most London waters, and the clear blue colour and transparency of chalk water, especially after softening. The disingenuousness of Dr. Tyndall is too remarkable to be passed over. Last year it might have been supposed from his lecture that no one before had had the slightest notion that the atmosphere was loaded with solid particles. This year it might have been inferred that no one before had dreamed of making an optical examination of water. The two-foot tube, however, is in constant use by water analysts, and the appearance revealed in the tube is precisely identical with that produced by the electric light; the one being a simple and practical test, the other a striking illustration for a clap-trap lecture.

Into the larger questions—first, as to the fitness of softened chalk water for human consumption; and next, as to the possibility of obtaining an adequate supply for London from the chalk—Dr. Tyndall did not enter. The Royal Commission on Water Supply gave some attention to the latter question, but limited their calculation to the chalk district to the south and south-east of the metropolis, from which they estimated that a daily total of 30 millions of gallons might be drawn—just a tenth of the quantity it is reckoned London will in a few years require.

The question of the adaptation of softened water for a supply is not so easily answered. Rich as are the opportunities in this country for an inquiry into the influence of a water supply on health, such an inquiry has never been made, and we have only the more or less crude conjectures of some medical authorities, who are, however, almost unanimous in recommending a moderately hard water as the best for human consumption. This opinion is well supported in an able letter, signed "Biologist," published in a recent number of the *Times*.

Returning for a moment to the complaints of carelessness in filtering, we must mention that Dr. Tyndall showed that after the water had passed through one of Lipscombe's filters, the appearance was but little improved—a circumstance which goes far to exonerate the companies from the charges brought against them. Further, it must not be forgotten that, although bright, the chalk waters are, as regards "previous sewage contamination," in a worse state than the polluted Thames and Lea waters.

Circular to Gas Companies.

We understand that the Board of Trade are preparing a Bill to amend the Sale of Gas Act, and it is presumed that the amendments will be based on the report of the commissioners appointed to inquire into the condition of the standards of weights and measures. It is desirable, therefore, that the whole matter should be well considered by gas companies. The recommendations of the commissioners were published at length in our number for Aug. 2 last year, page 589, but we may here again briefly refer to them, together with some documents printed in the appendix to the report which we have not before noticed. It will be remembered that the commissioners express great dissatisfaction at the limited application made of the principle of the Act of 1859. The amended Act of 1860, which resulted from the remonstrance made by Earl Cathcart and the magistrates of the North Riding of Yorkshire, rendered the adoption of the Act optional in counties, and the consequence has been that the Act is in force in only two counties—Gloucestershire and Carmarthenshire. The commissioners, however, consider that the objections brought against the Act are no longer tenable, having in view the continued extension of the consumption of gas, and they therefore consider it expedient that a general and uniform system of inspection of gas-meters should be established all over the kingdom. They recommend, in fact, that the Sale of Gas Acts should be repealed, and the provisions re-enacted in a general Act consolidating the laws relating to weights and measures. With some inconsistency, however, they would still leave the adoption of the Act in counties optional, so far as the inspection of meters is concerned, but would require a resolution not to adopt the measure to be carried by a majority of not less than two-thirds of the magistrates present in session when such resolution is proposed. The next recommendation is not very clear. It is: "That the local authority over the inspection of gas-meters "be in all cases exercised by the county magistrates, except in the me- "tropolitan district, where it should remain under the Metropolitan "Board of Works, and in such cities and boroughs as Parliament "may determine, with respect to the sale of gas, and in such cities "and boroughs as may be situated in counties in which the local "authorities stated in the preceding resolution (magistrates in "quarter sessions in England, Commissioners of Supply in Scot- "land, and the grand jury in Ireland) shall have determined not "to adopt the Act, where it should be exercised by the local "authorities." In counties the commissioners advise that the duties of inspector of meters should be exercised by the inspector of weights and measures, who is to be supplied with the requisite standards and appliances. All gas-measuring standards should be reverified by the Standards Department within a period of ten years; and all meters to be legal should be reverified and re-stamped within the same period. Meter-makers are to be licensed and registered, and each one is to have a distinctive stamp. Every meter is to be marked with the number of lights it is constructed to supply, each light being computed to consume 5 feet per hour at a pressure of 0·5 of an inch of water. Further than this, it is recommended that all the arrangements for the inspection of meters and weights and measures should be placed under the supervision of the Board of Trade, who should appoint one or more supervising inspectors to travel the country with official standards for the purpose of verifying local standards, and seeing that all the arrangements of the local inspectors are complete.

The Board of Trade seems nowise loth to carry out the recommendations of the commissioners, and have taken the first step towards that end, by making arrangements for the testing of station-meters, the necessary apparatus for which is being manufactured by Messrs. A. Wright and Co., of Millbank Street, Westminster, under the direction of Mr. F. W. Hartley.

With regard to the question of the adoption of a measure for the inspection of meters in counties, it will be remembered that the principal objection was the expense it would entail upon the ratepayers, for which it was alleged they were not likely to obtain any adequate return. The statement that in the metroplitan district the verification is attended with profit is not likely to remove the objections in counties with sparse populations, consuming comparatively little gas; and before the county scheme is revived, it might be expedient to inquire into the working of the Act of 1859 in the two counties in which it has been adopted.

The documents appended to the report of the commissioners are of great importance. The first is a "Memorandum on the "Testing of the Registering Apparatus or Indices of the Gas- "Meters," by Mr. H. J. Chaney, secretary to the commission and warden of the standards. The author starts with the assertion "that the present system of testing gas-meters enables any "person to construct a gas-meter which may register 20 or 30 "per cent. in his favour, and to have such a meter passed and "stamped as correct by the inspector of meters." This arises from the fact that under the present system the *measuring* part of the instrument only is verified, and not the registering apparatus. To ascertain the size of the drum or diaphragm chamber, the inspector is only required to pass through the meter a few cubic feet of gas or air, a quantity quite insufficient to test even the lowest of the dials commonly used, which is made to register hundreds of cubic feet; and without ascertaining whether the train of wheels which work the index are of proper arrangement—that is, whether ten revolutions of the "hundreds" dial cause one revolution of the "thousands" dial, and so on—a meter is passed as correct. But supposing a consumer of gas to be desirous of possessing a meter which should register in his favour, the wheels attached to the index of his meter may be so altered that *twelve* revolutions of the first dial would register only 1000, instead of 1200, on the second dial, and so on; and such a meter would, according to present practice, be stamped by any public inspector. It is not without reason, then, that Mr. Chaney proposes that the index and registering apparatus of every meter should be examined and stamped before it is fitted to the meter. There are some subsidiary recommendations, but the main proposal of Mr. Chaney is the distinct examination of every registering apparatus. The necessity for this seems to have been pointed out by the Astronomer Royal in 1860. In a letter to the Treasury, dated Feb. 11, 1860, he said: "Neither "the gas consumer nor the meter inspector ever examines the "wheelwork which connects the index-drum with the dial plates, "nor could they do so if desired. . . . The door, therefore, "is left wide open for any amount of error, even to the extent of "charging five times the quantity of gas really consumed, by an "error of blunder, or fraud in adjusting the train of wheels between "the index-drum and the dials; and the Act of 22 & 23 Vict., c. 66, "is nugatory and useless." And he goes on to quote a case within his own knowledge, in which it was proved to a gas company that by the insertion of an erroneous wheel the charge for gas consumed was doubled. The Astronomer Royal proceeds to point out methods by which the correctness of the whole train can be ascertained with reasonable facility. To these we need not at present allude. We may remark, however, that the eminent authority we quote returns again and again in subsequent communications to the Treasury to this necessity for the examination of the registering apparatus. "In regard," he says, "to the "operation of testing, I think it ought to be laid down as a duty "of the inspector, to examine the counting apparatus with refer- "ence to this required correctness, and to refuse his stamp unless "the counting apparatus admit of examination and be found

"correct. It is absolutely necessary (he adds) that this enact-"ment apply to meters now in existence."

Without going further, at present, with Mr. Chaney and the Astronomer Royal, we may turn to a paper by an eminent practical authority, Mr. William Sugg, "On the Working of the Sale of "Gas Acts." Mr. Sugg is as much dissatisfied with the working of the Act as the Astronomer Royal. "It cannot be said," he remarks, "after careful consideration, that the Sale of Gas Act "affords the consumer much greater protection than he possessed "before its passing, neither does it appear to be advantageous to "the seller. It professes to offer to the consumer a complete "solution of any doubts of the accuracy of the instrument which "indicates the quantity of gas he has used, and to the seller a "ready means of satisfying his customers that the claim to be "paid for the quantity of gas charged is just and equitable. "In truth, it is a delusion to both; for practice has shown that "the inspector's stamp may legalize the use of meters as tho-"roughly unreliable in their indications as those in use before "the passing of the Act may have been." One complaint Mr. Sugg makes is, that the Act leaves too much to the discretion of the inspectors, who may assume the right to reject instruments which, in their opinion, do not conform to the requirements of the Act, and so favour the instruments of particular makers. It is hard to see how this can happen, when the first clause of the Act distinctly says that the word meter is to include "every kind of "machine used for measuring gas." But Mr. Sugg's chief complaint is the same as that of Mr. Chaney and the Astronomer Royal — namely, that under the existing system every meter bearing the stamp of the inspector may be an incorrect one, because he makes no examination of the index or counting apparatus beyond the first dial. The remaining dials, which indicate hundreds, and may indicate millions, are left entirely to chance. He goes on to explain how indexes, by carelessness, ignorance, and fraud, may be made to go wrong, and mentions a case within his own knowledge, in which a stamped meter did not register millions correctly. Mr. Sugg's opinion is that indexes should be tested; and he points out that "an alteration in the method of making them would enable the "tester to examine them in a few moments. This alteration is "the abolition of all upright spindles or worms working into "cogs in the index itself. Of course this does not include the "vertical shaft which is driven by the worm fixed on the shaft "of the measuring-drum in water-meters, but those small shafts "which are now found in modern indexes, though they never "existed in the original ones. Thus, to verify an index, the "inspector could take it into his hand, and, with the pressure of "his fingers upon one of the high-number wheels, could cause "the entire index to make a complete revolution in, perhaps, "half a minute, when, if correct, all the pointers will be again "at zero. . . . The arrangement of the index, so as to be "removeable from the meter before the inspector's stamp is "affixed, is simple." Mr. Sugg further contends that the test for error should be made under a higher pressure than is prescribed by the Act, and suggests 1½ inch of water. Finally, he proposes that buyers and sellers, under certain special circumstances, should be allowed to agree mutually upon the use of an instrument, and that the fees paid for testing should be computed according to the number of lights, without regard to the capacity in cubic feet per revolution, a standard light being the consumption of 5 feet per hour, under a pressure of half an inch of water.

Mr. Mills, one of the inspectors under the Metropolitan Board of Works, suggests some alterations in the Act in a paper which the Board transmitted to the commissioners. The first is that all meters shall be tested by the inspectors of the district in which such meters are made, repaired, or used. At present a meter can be sent anywhere to be tested, and, as our readers will know, an inspector at Kingston has done a large business which should have gone to the metropolitan offices. Another suggestion is that a smaller fee shall be charged for the testing of a dry meter than is charged for a wet; in both cases, however, it is to be computed according to the amount of gas the meter is intended to deliver per hour. Lastly, Mr. Mills proposes that the inspector of a district shall have power to enter consumers premises at reasonable times for the purpose of examining and testing meters, and to remove meters for the purpose.

The last paper we may notice is "On the Inefficient Working of the Sale of Gas Act," by Mr. W. Crosley, who grieves to say that he finds the measure, instead of being a security to the public, in certain cases converted into a deception upon them; and from the experience which he subsequently details he might have said a terrible deception to gas companies also. He shows clearly enough that the carrying out of the provisions of the present Act in the provinces urgently requires that active supervision which the commissioners suggest under any future measure. Mr. Crosley makes a large number of suggestions, which go the length of proposing that the adoption of an Act should be made compulsory all over the kingdom, that the scale of fees should be revised, that wet meters should be reverified every five years, and dry ones every three years, a smaller fee being charged for dry meters; that station-meters should be tested, that uniform rates should be insisted upon, and that no meter-makers, directors, or shareholders in gas companies should have a voice in the appointment of a district inspector.

The foregoing abstracts will give our readers an idea of the nature of the evidence upon which the recommendations of the commissioners are founded, and will, no doubt, convince every one that an amendment of the Sales of Gas Acts is urgently required.

Mr. Barlow, the arbitrator appointed under the Bridgend (Glamorganshire) Gas and Water Act, 1869, has made his award, under which £4713 will be paid to the owners of the gas-works for their interest in the undertaking. The amount claimed on behalf of the vendors by Mr. T. Dyne Steel, civil engineer, Newport, Monmouthshire, was £6835; and the sum offered by Mr. Thornton Andrews, of Swansea, on the part of the purchasers, was £2078. The peculiarity in the case was, that not only were the works erected on leasehold property having but 38 years to run, but the mains also were held under a similar tenure, and passed to the freeholder on the termination of the lease.

The orders applied for under the Gas and Water-Works Facilities Act, abstracts of which we publish, offer little for comment. The practice respecting these seems not yet to be settled. In some cases, a simple draft "order" is published, while in the majority of cases the Bill which is to confirm the order is printed. Opposition seems likely to be encountered in one or two cases, and we shall learn the proceedings the Board of Trade will adopt for hearing and deciding between the parties. The application of the Bushey and Watford Gas Company, we are informed, will not be proceeded with.

The almost superhuman heroism of the Parisians has proved fruitless, and Paris succumbs to famine. It will be long before we know the whole extent of the suffering endured during the five long months of the investment; but when, in after times, history sums up all the incidents of the siege, we shall, no doubt, be told how much the total absence of gaslight has added to the moral suffering of the population. Let any one imagine what the condition of London would be if deprived of gaslight through the darkest months of the year, and his sympathy for and admiration of the Parisians, during their long agony and enforced darkness, must be enormously increased. Of the officials of the Paris Gas Company we have, unfortunately, no information; but a letter from our respected *confrère*, the editor of the *Journal de l'Eclairage du Gaz*, recently sergeant in the 14th Mobiles, informs us that he had the misfortune to be taken a prisoner of war in the sortie on Bourjet on Oct. 30, and has since been interned in a Prussian fortress. The publication of his journal ceased when the blockade commenced, but we hope soon to be able to announce its reappearance. The gas-works at Strasburg have been so far repaired that the city within the fortifications is now again lighted with gas. As regards gas affairs in other parts of France there is not much to report. The works of the Continental Union Gas Company at Rueil are said to have suffered nothing from the firing from Mont Valérien. Those of the European Company at Amiens have sustained but slight injury other than that resulting from diminished consumption. The stocks of coals remaining in these cities are still ample.

The Walsall Improvement Bill was opposed by the Birmingham and Staffordshire Gas Company before Mr. Frere, the examiner, who decided on the 23rd of January that, with respect to the extension of the area for supply of gas, the notice of the Bill was insufficient, and he therefore reported that the Standing Orders had not been complied with.

Legal Intelligence.

COURT OF CHANCERY.—TUESDAY, JAN. 17.
(*Before the* LORD CHANCELLOR.)

THE GRAND JUNCTION CANAL COMPANY *v.* SHUGAR AND THE TRING LOCAL BOARD OF HEALTH.

This was an appeal by the plaintiffs, the Grand Junction Canal Company, from an order of the Master of the Rolls dismissing their bill, by which it was sought to restrain the Tring Local Board of Health from diverting the water of a pond, called the Silk Mill Pond, and the springs which fed it, so as to affect the supply of water that had hitherto flowed into the Wendover arm of the Grand Junction Canal at the summit level near Tring.

The grievance complained of arose out of the works for draining the town of Tring, which were commenced by the local board in May, 1867. In the course of these works a culvert had been constructed by the local board which had had the effect of tapping a certain pond, called the Silk Mill Pond, from which the plaintiff company, by a brook falling into the Wendover arm of their canal at the summit level, had derived considerable supplies of water. In consequence of this diversion the plaintiff company had been compelled, at great expense, to pump water from the Tring Ford Reservoir into their canal. It was also made a ground of complaint that in consequence of the drainage works a large quantity of sewage and offensive matter now found its way into the canal. In restraint of this diversion of water the plaintiff company had filed

their bill, which was dismissed by the Master of the Rolls in April of last year. The plaintiff company now appealed.

Sir ROUNDELL PALMER, Q.C., Mr. JESSEL, Q.C., and Mr. LEONARD FIELD appeard in support of the appeal; Mr. EDDIS, Q.C., and Mr. LINDLEY were for the defendants.

The LORD CHANCELLOR said that the question was whether the plaintiff company were entitled to an injunction against the Tring Local Board to prevent them from continuing the inconvenience occasioned by the drawing of water from a pond from which water was conveyed by a regular channel to the plaintiff's canal. All question of *laches* on the part of the canal company was removed by the correspondence that passed immediately the works of the local board were commenced. The effect of those works was that the mill-pond was left all but dry, so that the principal supply of water to the canal was withdrawn from its regular channel. Upon the facts of the case, therefore, there was enough to justify the court in saying that the damage occasioned to the mill-pond should not be continued. Then, as to the law of the case, a distinction was established upon the authorities between water confined and flowing in a regular channel and water which percolated underground or flows on the surface in an unknown course, depending on the quantity of rain falling or the natural moisture of the soil, coming one knew not whence, and flowing one knew not how. In the case of underground water, your neighbour had as much right to sink a well as you had, and no action would lie against a man who, by digging wells or cutting drains in his own land, thereby drained his neighbour's land also. But, on the other hand, the right of enjoyment of flowing water in a surface stream must not be interfered with, and in this case, *ex concessis*, there was a definite channel in which water was accustomed to flow into the plaintiff company's canal, which flow of water had been interfered with. And, again, if a man could not sink his well or get at his underground water without interfering with a definite channel of surface water, he could not be allowed to do so. He could not at all concur in the judgment of the Master of the Rolls. It was not a case for compensation in damages, but plainly for an injunction, which would accordingly be granted against any diversion of surface water, and the defendants must pay the costs of the suit.

COURT OF QUEEN'S BENCH.—WESTMINSTER, JAN. 27.

(*Sittings in Banco, before Justices* BLACKBURN, MELLOR, *and* LUSH.)

FORMAN AND WIFE *v.* THE CORPORATION OF CANTERBURY.

This was a case which raised a question of some public interest. It was an action against the Corporation of Canterbury, the local board, and, as such board, surveyors of highways, for an injury caused to Mrs. Forman, the female plaintiff, by the negligence of their servants. It appeared that their men had placed upon a road going out of Canterbury, 20 feet wide, a heap of stones, extending 7 feet across the road, and had left it there without a light. The plaintiff was driving his wife, on a dark night, along the road, and the horse, not seeing the obstruction, ran the chaise up against it and upset it. The result was that the wife was very seriously and permanently injured, having lost the use of her arm for life, and being so disabled as to necessitate the employment of a housekeeper. The defendants counsel at the trial before Lord Chief Justice Bovill, at Maidstone, last summer, admitted that the Board caused the obstruction, but insisted that there was no liability for it, as they had a right to put stones or other materials on the road for the purpose of repair. The Lord Chief Justice, however, ruled that they were bound to use reasonable care in so doing, in order to avoid danger of accidents, and it would be for the jury to say whether they had been guilty of negligence, or whether, as was suggested, the accident happened by reason of the darkness of the night. The jury found for the plaintiffs—damages, £1200—and the Lord Chief Justice at the time declared that he was satisfied with the verdict. The verdict was now impugned on the ground that the corporation were only liable as local board and as surveyors of highways; and that, in that capacity, they were not liable to an action.

Mr. HAWKINS, Q.C., and Mr. ARCHIBALD were for the plaintiff; Mr. DENMAN Q.C., and Mr. G. FRANCIS were for the corporation.

The COURT were clearly of opinion that the action was maintainble against the corporation, as it was admitted that their servants had caused the obstruction.

Judgment for the plaintiffs.

COURT OF COMMON PLEAS.—SATURDAY, JAN. 28.

(*Sittings in Banco, before Justices* KEATING, SMITH, *and* BRETT.)

THE LIVERPOOL UNITED GAS COMPANY *v.* THE OVERSEERS OF EVERTON.

This was a rule for a prohibition to prohibit the Recorder of Liverpool from trying an appeal against a poor-rate.

Mr. QUAIN, Q.C., and Mr. PERRONET THOMPSON showed cause against the rule; Mr. DOWDESWELL, Q.C., and Mr. SEGAR appeared in support of it.

Mr. QUAIN said he appeared to show cause against a rule obtained by Mr. Seager for a prohibition against the Recorder of Liverpool from hearing an appeal of the late gas company against a poor-rate made on the 8th of July last, the ground for asking a prohibition being that the appeal was not in accordance with the statutes, and that therefore the recorder had no jurisdiction to permit the appeal to be entered, or to try it at the sessions held on the 26th of October. The facts of the case were that the rate to which the appeal referred was made on the 8th of July; and as it had been decided by this court that the appellant was bound in the first instance to go before the Assessment Committee, the plaintiffs did so on the 3rd of August. The relief they sought was refused, and it was evident they could not have appealed before that time. The next sessions was held on the 1st of September, and it would be for their lordships to decide what was the character of that sessions. The appeal was not made then, and it was contended that it ought to have been. The sessions was held by the recorder under the Municipal Corporations Act, which enacted that the recorder of every borough should hold, once a quarter, a court of quarter sessions. At Liverpool a greater number of sessions were held, it being optional with the recorder when he should hold them. He generally held seven or eight sessions in the year, and the practice was to give ten days notice of his intention to hold such sessions. They were not like county sessions, held in certain defined weeks. Last year the Recorder of Liverpool held a sessions on the 18th of July, which was immediately after the rate in question was made. The next was on the 1st of September, and then on the 26th of October. It was for the court to say whether every sessions held was a quarter sessions under the Statute.

Mr. Justice MONTAGUE-SMITH: If it is not a court of quarter sessions, what is it?

Mr. QUAIN thought it might be an intermediate or a general sessions.

Mr. Justice MONTAGUE-SMITH said that according to the words of the Act there must be four quarter sessions held in the year, and there might be more.

Mr. QUAIN said there was a well-known distinction in counties; but it was a question whether it was the same in boroughs. This matter came before the recorder on the 26th of October, and the overseers objected that the appeal was too late. The recorder decided that the general rule of law was that by "next quarter sessions" was meant the next practicable sessions, and in his judgment that was the next practicable sessions. He accordingly allowed the appeal to be entered. The Act of Parliament required twenty-one days notice of appeal to be given to the Assessment Committee, so that there would only be six days for the company to decide on appealing, between the interview with the Assessment Committee and the time necessary for giving notice of intention to appeal at the sessions to be held on the 1st of September. The learned recorder thought that six or seven days was not more than sufficient for the company to consult counsel, and consider whether they should appeal. The sessions held in October were, therefore, the next practicable sessions.

Mr. Justice BRETT thought the recorder had jurisdiction to consider whether six days was a reasonable time, and whether the October sessions were the next practicable sessions. It was a question whether he was right or wrong in his judgment.

Mr. QUAIN quite agreed that it was for the recorder to inquire into the facts.

Mr. Justice BRETT asked why the parties had come to this court instead of going to the Queen's Bench.

Mr. QUAIN said it was because the Biggleswade case had been decided in this court. He submitted that if the recorder had a right to decide what was the next practicable sessions, there was an end to the rule, even if the court thought the learned recorder was wrong, inasmuch as it was within his jurisdiction, and the prohibition would apply. The company could not tell when the court of sessions would be held until the 21st of August, by which time it would be too late to give notice for the court held on the 1st of September. On the whole case, he submitted that no one knew so well as the recorder what was convenient to the court and the parties.

Mr. PERONNET THOMPSON followed on the same side, pointing out that, if the rule were granted, all possibility of appealing against that rate would be at an end.

Mr. DOWDESWELL, Q.C., for the overseers, said that the point as to the sessions being quarter sessions never arose before the recorder.

Mr. Justice MONTAGUE-SMITH thought that had not been relied upon by Mr. Quain.

Mr. QUAIN assented.

Mr. DOWDESWELL then stated that the recorder had abstained from giving an opinion, but agreed to state a case, or intimated that they might apply for a prohibition. A *mandamus* was only granted where a court refused to act; but where a judge exercised a jurisdiction which he did not possess, then the proper course was by prohibition.

Mr. Justice MONTAGUE-SMITH did not remember a case where the Court of Queen's Bench granted a prohibition against a court of quarter sessions as to entering an appeal at what they considered to be the next practicable quarter sessions.

Mr. Justice KEATING thought the learned counsel ought to show the recorder was clearly wrong.

Mr. DOWDESWELL referred to the statutes which, he submitted, governed this case. By them it was enacted that an appeal should be entered at the next quarter sessions; but if the proper notice had not been given to the Assessment Committee, then it was for the justices to adjourn the hearing of the case to the following session. It had been held by the courts that the justices had no option but to enter the appeal, and then to respite it if proper notice had not been given. Therefore, the gas company ought to have entered their appeal for the September sessions; and if sufficient notice had not been given to the Assessment Committee, then the recorder would have respited the hearing to the October sessions. That, he contended, was the proper course for the appellants to have pursued, and, as they had not done so, it was not competent for the recorder to entertain the appeal in October.

Mr. SEAGER followed on the same side, submitting that this court had all the facts, and more than the facts, that were before the recorder.

Mr. Justice KEATING, in delivering judgment, said that Mr. Quain had properly abandoned as untenable the contention that the Liverpool sessions were not quarter sessions, as they undoubtedly were so within the words of the Statute. The court were of opinion that the recorder was wrong in deciding that six or seven days were not sufficient to make this a practicable sessions; and they did not see any difference of power whether the motion was for prohibition or a *mandamus*. In either case the court must have power to examine the decision of the court below. The next practicable sessions was that of the 1st of September, and the October sessions was not a time when the appeal could be entertained. The prohibition, therefore, must be affirmed.

The other learned judges concurred.—Rule affirmed.

COURT OF GENERAL ASSESSMENT SESSIONS FOR THE METROPOLIS.

The Court of General Assessment Sessions, being the final court of appeal, appointed under the Valuation (Metropolis) Act, 1869, met on Monday, Jan. 23, at the Guildhall, Broad Sanctuary, Westminster, for the purpose of fixing the days upon which the respective appeals shall be heard.

The justices present were Sir W. H. Bodkin (in the chair), Mr. Henry Pownall, and Mr. Henry Morris Kemshead, representing the county of Middlesex; Sir Thomas Tilson representing Surrey; Mr. T. M. Ryley and Captain Robert Robertson, R.N., representing Kent; and Mr. Alderman Finnis, and Mr. Alderman Carter, representing the City of London.

Mr. FRANCIS (the clerk) read the list of appeals, which at present numbers eighty-two. This number may, however, be increased upon special application. Amongst those set down for hearing are the following:—

No.			
3	Southwark and Vauxhall Water-Works Company	*v.*	St. Mary, Lambeth.
4	Same	„	Clapham.
8	Abney Park Cemetery Company	„	St. Mary, Stoke Newington.
10	Grand Junction Canal Company	„	Paddington.
19	Lambeth Water-Works Company	„	St. Mary, Lambeth.
24	Surrey Consumers Gas Company	„	St. Mary, Rotherhithe.
29	Regent's Canal Proprietors	„	Paddington.
30	Same	„	Hamlet, Mile End Old Town.
31	Same	„	St. Leonard, Shoreditch.
32	Same	„	St. Anne, Limehouse.
40	Phœnix Gaslight and Coke Company	„	Lewisham.
41	Same	„	St. Mary, Lambeth.
42	Same	„	Greenwich.
43	New River Company	„	St. Mary, Stoke Newington.
44	Same	„	St. John, Hackney.
45	Assessment Committee of Greenwich Union	„	Charlton, Plumstead, and Woolwich.
61	East London Water-Works Company	„	St. John, Hackney.
77	Kent Water-Works Company	„	Charlton.
78	Same	„	Eltham.
79	Same	„	Plumstead.
80	Same	„	Lee.

On an appeal being mentioned by the Marine Society against the valuation by the parish of St. Ethelburga,

Mr. WEBSTER said that an agreement had been come to between the parties to reduce the rating to £167, without costs, so that the court would have no further trouble in this matter.

In the case of the appeal by the corporation for middle-class education in respect to rating in the parish of St. Luke, Old Street,

Mr. T. THOMPSON said this question also embraced the rating of the property in the parishes of Saffron Hill and St. Andrew, Holborn, and the appeals were not only as to the amount, but the form of making these rates, and he urged the onus of proof as to error in form would rest upon the appellants, and not upon the respondents.

The hearing of these cases was deferred *sine die*.

Mr. CASTLE said that there were a great number of cases in the parish of

St. Mary, Lambeth, and six or seven of them had been settled by consent. Only about three would be fought out, and the result would determine the rest, which were those of great public companies.

There were six appeals by the Lord Mayor and Corporation of London against the rating in the parishes of St. Mary Woolchurch, St. Sepulchre, St. Bride, the Liberty of Saffron Hill, and St. Andrew, Holborn.

Mr. POLAND said these would all be questions of great public importance. One of them was, how far a portion of the Mansion House, which was devoted to the administration of justice, was liable to be rated at all, and in the event of that being settled in the affirmative, then a further question would arise as to the amount of the rate. The other two cases against the parish of St. Sepulchre, in the City, was as to the rating of the New Metropolitan Meat Market, which he need hardly say was a very difficult question, and it was as to whether the tolls collected in the market were rateable. That was a question that was already before the Court of Queen's Bench, and stood for hearing, and after a decision had been given as to whether market tolls were rateable or not, there would be no necessity then to go into the question of figures. That was an important question, and he submitted that the consideration of it by this court should be deferred pending the decision of the Court of Queen's Bench.

Sir W. H. BODKIN said there would be some difficulty, unless the appeal were heard in time.

Mr. POLAND said it was very low down in the paper, and he was afraid it would not be decided before the next term. An application would be made to hear it out of its turn, but he did not think the court would grant it. There was another appeal as to the vacant ground near the Holborn Viaduct, and that appeal would require a special consideration. The same question would have to be raised in all the cases.

The consideration of all these cases was deferred.

The Mutual Tontine (Westminster Chambers) Association appealed against the rating of St. Margaret and St. John, Westminster. In this case Mr. POLAND said two questions would arise as to whether the building only should be rated, or each set of offices rated separately. If the latter were so decided there were about 300 of them. In that case, then, the chief point for consideration would be the question of value.

These cases were ordered to stand over indefinitely.

Arrangements were made when several appeals should be heard to suit the convenience of parties concerned.

The South-Eastern Railway Company appealed against the parishes of St. Mary, Lambeth; Lee, Lewisham, Charlton, Woolwich, Plumstead, and Kidbrooke. It was arranged, on the application of Mr. Poland, that all these cases should stand for the 4th of February.

The following order of court was made and agreed to:—"That in every case in which it shall appear to the court for some reasonable cause the recognizances directed by the order of the court of the 23rd of June, 1870, numbered 2, to be entered into by the appellants and their sureties, or any of them, have been omitted to be entered into in conformity with the said order, and that some sufficient security for the payment of any costs that may be awarded to be paid by the appellant has been given in substitution or part substitution for the same recognizances, the court may, if it sees fit so to do, waive all or any such recognizances, and proceed to hear the appeal, notwithstanding such omission. And if in any case it shall appear to the court such substituted security as hereinbefore mentioned shall not be sufficient, the court may, if it shall think fit to do so, order such increased or additional security to be given or entered into as to the court may seem just; and may, if necessary for the purpose of such order being complied with, postpone the hearing of such appeal until such time and upon such terms and conditions as to costs or otherwise as the court shall think fit."

The CHAIRMAN said this order was made to meet the cases of public companies.

It was arranged that the first cases should be heard on the 4th of February, for which day a number were arranged to be taken. The next sitting would be on the 13th of that month.

CLERKENWELL POLICE COURT.—TUESDAY, JAN. 24.

(*Before Mr.* COOKE.)

Mr. *William Sterling*, gas-fitter, &c., of 28, Woodbridge Street, Clerkenwell, was summoned at the instance of the Gaslight and Coke Company for having "unlawfully disconnected a certain meter by which the said gas company's gas had been registered at certain premises, situate and being 50, King's Square, without giving twenty-four hours notice in writing to the said company of your intention so to do." The maximum penalty for this offence, under the 68th section of the company's special Act, is £5.

Mr. HUMPHREYS, solicitor, attended for the prosecution, and Mr. MONTAGUE SCOTT, solicitor, for the defence.

The defendant pleaded guilty, and it was stated on his behalf that he had no intention of defrauding the company, but that what he had done was for the interest of his customer, whose works were stopped in consequence of his gas-meter, which was a wet one, having become frozen. The defendant substituted a dry one, and whilst he was in the act of substituting the one for the other the company's inspector called and caught him in the act. As the disconnecting of meters was fraught with great danger to life, limb, and property, the present proceedings were taken, and it was shown that in addition to the defendant being a gas-fitter, and therefore well knew he was doing wrong, the secretary of the above company had written to him in May of last year cautioning him that if he continued disconnecting the company's meters he would be punished. The other officia s had also cautioned him, and it was stated that the plea of urgency that was set up was of no avail, as if the customer had sent to the company the evil would at once have been remedied.

Mr. COOKE said that he considered this a proper prosecution, and remarked that, had he thought the defendant had intended, in doing what he did, to commit a fraud, he should have inflicted the full penalty of £20 and the costs. As it was the defendant would have to pay a penalty of £3 and the costs, or in default one month's imprisonment in the House of Correction.

The money was paid.

Miscellaneous News.

METROPOLITAN BOARD OF WORKS.

The usual Meeting of the Metropolitan Board of Works was held on the 27th inst., at the Office in Spring Gardens—Colonel HOGG in the chair.

THE SEWAGE QUESTION.

A report was presented from the Works and Improvement Committee on the question of dealing with the sewage of the metropolis for agricultural purposes. The report is as follows:—

Spring Gardens, Jan. 23.

Your committee have to report that they have had under consideration the various communications from the Native Guano Company with reference to their A. B. C. process of utilizing sewage. The subject was originally referred to your committee as far back as the 23rd of December, 1869, on which day a deputation from the company attended the board with a view of explaining their system, and expressed a desire to enter into treaty with the board for a promise of concession of the sewage on the south side of the Thames, on satisfying the board that they were in a position to accomplish the purification of sewage and to comply with the board requirements. On the 28th of January, the committee expressed an opinion that it was the duty of the board, in the interests of the ratepayers, to examine thoroughly every reasonable scheme submitted to them for the utilization of sewage, and, considering that a sufficient case had been made out by the Native Guano Company to justify the board in following up their inquiry, your committee recommended the board to visit the company's works at Leamington, and inspect the process of manufacture. The views expressed by your committee met with the approval of the board, but the pressure of business prevented them from carrying out their intended visit until the 8th of July, when it will be remembered several members of the board proceeded to Leamington and inspected the works. It should be mentioned that the board's consulting chemist, Mr. Keates, had previously reported on the process, and the visit of the board to the works appeared to confirm the view expressed by Mr. Keates, that it was difficult to come to an absolute judgment of the value of the process without giving some considerable time to the examination of the question, and carrying on an investigation of the subject for a definite period. Mr. Keates was instructed to make such an investigation, but the then condition of the company's works at Leamington rendered it, in his opinion, useless to pursue the inquiry at the time, as he reported to the board on the 5th of August last. At the first meeting of the board after the autumn recess a letter from the company was presented, stating the disadvantage their process was under, owing to the inconvenient works at Leamington and the infiltration of salt water into the sewers at Hastings, and submitting a proposition that the board should grant the company permission to erect, at their own expense, works at either Barking or Crossness to treat about 500,000 gallons of sewage daily. This letter was referred to your committee, and has since been under their consideration from time to time. In a subsequent letter addressed to your committee, stating the reasons for preferring the construction of works at Crossness or Barking to the continuation of any inquiry at Leamington, the company expressed their strong confidence in their system, the value of which they are prepared to put to the proof, at their own cost and risk, and without asking for any promise or stipulation as to the future. A deputation from the company has attended your committee, and gone very fully into the chemical, financial, and mechanical features of their scheme. Into the two former of these your committee think it unnecessary to enter further then to state that the company represent that, by an improvement in their process, they have removed all that was offensive in the manufacture, and have, at the same time, considerably lessened the cost of production.

With regard to the works, your committee understand that the company desire to erect two tanks, each capable of containing 125,000 gallons, by the agency of which they state that they will be enabled daily to effect the conversion into solid sewage matter of the deposit from the 500,000 gallons of liquid which they desire to operate upon. Your committee have attentively considered this matter, and, having regard to the fact that the board will incur no pecuniary or other responsibility in acceding to the request of the company, and, moreover, that the erection of the company's works is to be regarded purely in the light of an experiment, in the success or failure of which the board are in no way involved, your committee think that the board may with propriety accede to the wishes of the company, subject to suitable restrictions. The recommendation which your committee beg to submit is as follows:—

"That the Native Guano Company be permitted to erect, at their own expense, and for a period not exceeding twelve months, works at Crossness for the purpose of treating, by their A. B. C. process, about half a million gallons of sewage daily, subject to the works being carried out to the satisfaction of the board's officers, and to the effluent water being made to flow into the river by means of an open channel; subject also to the company entering into an agreement, to be prepared by the solicitor, for carrying the arrangement into effect, and for preventing the board from being in any manner bound to the company."

Mr. RUNTZ, in moving the adoption of the report, said the company had tried their process at Leamington, Southampton, Hastings, and other places, and in each case they had been attended with failure; but now they had got a new patent, by which they could dispense with an expensive ingredient in their process, and substitute a cheaper one. Hitherto they had had to pay seven guineas per ton for alum; but now they had discovered that the clay in the vicinity of their works at Leamington would answer the purpose just as well, and they believed themselves to be in a position to carry out their scheme, and, in consequence of the recent discoveries made, he thought it was the duty of the board to do what they could to help them in their work. The board would be placed under no responsibility in the matter, and it was deemed desirable that the company should be permitted to try their experiment, and ascertain how far the sewage could be utilized.

Mr. E. DRESSER ROGERS proposed an amendment to the effect that the matter should be referred back to the committee, with instructions to them not to permit the erection of the works at Crossness until the company demonstrated that they were capable of carrying out what they proposed, and until the agreement to be entered into with them was submitted to the board. He thought the ratepayers of London ought to obtain something like a profit from the sewage of the metropolis. It was admitted that all the attempts hitherto made by the company as to the utilization of the sewage had proved abortive, and that being so, he thought the board ought to pause before they made to any company so large a concession as that now proposed.

Mr. SHAW seconded the amendment.

Mr. NEWTON said no agreement would be entered into without the authority of the board after it had been carefully prepared by their own solicitor. The company proposed to expend £5000 in an experiment in trying to utilize what the board was now throwing into the river, and if they succeeded in doing so it would be a great public advantage.

Mr. DRESSER ROGERS withdrew the amendment, and the report of the committee was unanimously carried.

THE FARMER THEOREM OF GAS-BURNERS.

NOTE ON MR. STIMPSON'S PAPER ON FARMER'S THEOREM,
By B. SILLIMAN.

[From the *American Journal of Science and Arts.*]

Mr. Stimpson's criticism on the first experiment of my paper was induced by an obvious numerical error in the statement of the data, which Mr. S. has himself corrected in a foot-note. The experiment properly stated exactly sustains the theorem.

I admit that in experiment No. 2 the exponent comes nearer to the third power than to the square, being 2·689, 2·638 and 2·669; in the three cases average 2·661. But it also indicates that the illuminating power of the standard 3·30 cubic feet was very imperfect. The experiments, however, appear to me to demonstrate clearly the radical inaccuracy of the old rule for photometric calculations, and that some ratio near to or greater than the square gives often more trustworthy results than the old rule.

In experiment No. 3, the exponents are respectively 2·552, 2·297 and 2·092, coming in the last very near the square. It shows that 4·88 cubic feet consumption gave the best results, and also that 3·72 and 7·219 cubic feet consumption gave very nearly the same degree of intensity of combustion.

In experiment No. 4, the exponent 1·85 power for a consumption of 9·519 consumption, shows an imperfect combustion of the fishtail burner employed.

In experiment No. 5, the experimental conditions were wholly unfavourable to accuracy, owing to an inequality of pressure unavoidable in the experimental method adopted, there being one inch pressure on the 10·06 cubic feet consumption, and only half an inch on the 5·16 cubic feet. It is well known to all photometric observers how important a low pressure and an equal pressure is to the results obtained. It was hardly fair to Mr. Farmer to have quoted this trial, but I was desirous of exhibiting the entire range of observation, bad as well as good.

As in experiment No. 6 the consumption of sperm was in the two tests very nearly uniform, the difference would be very trifling if the correction had been applied. Nor is it by any means so certain that Farmer's theorem applies to the candle, as I supposed when the remarks quoted by Mr. Stimpson were made, since, if a candle burns much over 120 grains it smokes ("tails off"), and then there is an end of all accuracy, and the observation must be rejected, since there is an imperfect combustion giving an increase in consumption but not in intensity.

Mr. Stimpson rejects all the data given by me which are founded upon the determination of the intensity of a rich gas by the "method of mixtures" because,

as he says, the accuracy of this method has not yet been demonstrated by experiment. But this objection ceases to have force now that experiments, made by Mr. Farmer and myself lately, prove that this method is worthy of confidence. Inasmuch as the most important case for the use of Farmer's theorem is that of gas too rich to be burned in the standard burner on a basis of 5 cubic feet per hour, it is striking off by all means the most valuable portion of my contribution to photometrical methods if it could be shown that the "method of mixtures" was untrustworthy. I am, therefore, glad of this occasion to reiterate my confidence in this method, and to refer the reader curious in such matters to a brief paper of mine upon this subject, which will be found on page 379.*

I care very little whether the results of experiment shall show, when they are sufficiently accumulated, that the ratio of consumption of gas is to the intensity produced as the squares of consumption in a given case, or in some other ratio greater than a simple ratio. I have desired chiefly to call attention to the general untrustworthiness of all photometric observations which are made with volumes of gas much less than the normal standard adopted, when these results are calculated on the simple ratio of the consumptions. It is only by the accumulation of carefully conducted experimental data that a law can be established, and these data are now pretty rapidly accumulating.†

LECTURE ON LIGHT.

On Monday Evening, Jan. 23, Mr. A. H. Wood, the able and esteeedm manager of the Hastings gas-works, delivered one of his popular and instructive lectures at the Mechanics Institution of that town. The subject was "Light," and was illustrated by several experiments, which were well performed. There was a numerous attendance, and the president of the institution (J. C. Savery, Esq.) occupied the chair.

Mr. Wood commenced with an introductory reference to Sir Isaac Newton and his studies, and after explaining that he intended to make his lecture as much as possible of an elementary character, he drew attention to the corpuscular theory of light. Sir Isaac Newton believed that every self-luminous object threw off particles of light which reach the retina of our eye, and give the sensation of light. That was disputed by many in Sir Isaac Newton's day.

e (the lecturer) thought that if there was truth in the corpuscular theory there must be truth in the meteoric theory of the sun, because if that celestial body was for ages throwing off particles of itself, a time must come, according to human ideas, when it would be lessened in gravity, and the great balance of things in the universe would be interfered with. Mr. Wood alluded to the undulatory theory as one generally believed in the present day, and he illustrated that theory by applying the principle to sound. He explained that sound travels in waves, the length of which are supposed to vary according to the height of the note, and that, he said, afforded an idea of the undulatory theory of light. It was supposed that the universe is filled with ether, and this ether is thrown into vibrations, which, on reaching the retina of the eye, gives the sensation of light, in the same way as sound reaches the ear. He explained that there is difference in the number of waves produced by the several rays of light, the red rays producing 458 millions of millions in a second, while the violet produced only 727 millions, the red rays being properly termed the bass, and the violet rays the treble of light. In speaking of the nature of the luminous ether, Mr. Wood alluded to experiments performed by Mr. Belford Stewart, Professor Tate, who had produced frictional heat by causing a disc to revolve in a vacuum, and he repeated the opinion given by Professor Tyndall that the ether of the whole universe could be so compressed as to be placed in a gentleman's portmanteau, and that it was so light that it could be carried away in the hollow of one's hand. He next drew attention to the compound nature of light, which he said had never been questioned, and showed how Sir Isaac Newton analyzed the white light by introducing it through a hole in a wall, and bringing it to a prism, from which a fanlight of seven colours was sent forth. After producing a white light by the blending of the seven colours in a rapidly revolving disc, the lecturer referred to the opinion of Sir David Brewster, that the three primary colours, red, blue, and yellow, really formed the seven colours of the spectrum, and from those three colours he produced a nearly white light. He explained that the green and red contained the elements of nearly all the other colours, and produced nearly white light, and he showed how the seven colours could be brought back into a perfectly white light. The heating, illuminating, and chemical rays of light were next referred to, and it was explained that by a very delicate experiment it is possible to filter the rays of heat from the rays of light, and to use them for heating purposes without a single ray of light passing through. The chemical rays are those of the violet end of the spectrum, the light-giving rays are in the centre, and the heat-giving rays are from the red. The spectrum analysis was next alluded to by Mr. Wood, who, in order to explain clearly what it is, drew attention to chemical analysis. He mentioned the difference between the continuous and the broken or irregular spectrum, the former being produced by anything in a solid form, and the latter by light in a gaseous form; and he then illustrated what is termed the double spectrum, consisting of the continuous spectrum, and a number of black lines over it. After an allusion to the spectrum of metals and earths, the lecturer offered some remarks on the spectrum of the sun, mentioning the sixteen metals which are in a state of ignition on the solar surface. The protuberances of the sun, as seen during the recent eclipse, were described in passing, and the lecturer next spoke of the stars and nebulæ, and the spectrum which they displayed. He then offered some interesting remarks on monochromatic light, showing the difficulty in detecting the real colour of material when exhibited by different coloured lights, and giving some brilliant experiments with the lime-light. In conclusion, he spoke of the subject as one that was characterized by considerable mystery, and that presented a wide field for further investigation and study. He resumed his seat amidst hearty applause.

Mr. John Banks said, as one of the oldest members of the institution, he should take the liberty of proposing a unanimous vote of thanks to Mr. Wood for his very interesting lecture. In the early part of that lecture Mr. Wood brought to his recollection the fact that he used to pursue practical science in his (Mr. Banks's) school-room. He was sure that he ought to be proud of his pupil, although he did not take credit to himself for having done more than give him elementary instruction. Some persons were apt to underrate the value of science, but he thought the lecture delivered on the previous Friday by Professor Tyndall furnished a reply to those persons, and that the practical utility of science was also shown by Mr. Wood in his management of the gas-works. He was sure they owed a debt of gratitude to Mr. Wood for his very interesting lecture.

Mr. Joshua Huggett seconded the vote of thanks.

The President, in putting the motion, spoke of the success with which Mr. Wood had performed his experiments—a success which, he thought, was equalled only by those given in Mr. Banks's lectures—and he expressed a hope that the members would be led to investigate the subject further, so that they might be able to appreciate still more the great care and skilfulness with which Mr. Wood had catered for their instruction and amusement.

The vote of thanks was accorded by acclamation, and Mr. Wood having acknowledged the same, the proceedings terminated.—*Hastings and St. Leonards Chronicle.*

SOCIETY OF ARTS, ADELPHI.

At the Sixth Ordinary Meeting, held on Wednesday, Dec. 21, 1870—Sir A. Brady in the chair—the following paper, by A. M. Silber, Esq., was read:—

ON A METHOD OF LIGHTING TOWNS, FACTORIES, OR PRIVATE HOUSES BY MEANS OF VEGETABLE OR MINERAL OILS.

We are all familiar with gaslight. It meets our sight wherever we turn, on passing any evening through the busy thoroughfares of populous London. Accustomed as we are to the sight of the brightly illuminated shops and streets, we are scarcely able to realize to ourselves how people fared before the introduction of coal gas; and yet it is barely sixty years since gas was first thought of as a general illuminant, and in this comparatively short time it has almost entirely superseded—at all events, in our large towns—the sources of light known at the beginning of this century—viz., vegetable and animal oils, and fats of various origin, which, for centuries past, formed the exclusive illuminating material of rich and poor.

The eye is occasionally attracted in our business streets by brilliant white lights, displayed in shop windows, burning from lamps of novel construction, which strike the Londoner, accustomed as he is to gaslight, as a vast improvement upon the latter. These are the so-called paraffin lights. Who has not stopped for a moment to muse over the cheerful sight, and has gone his way saying to himself, "This is really a pleasant light; will it ever take the place of gaslight?" In many a humble dwelling in this country, and more so in other countries—in Norway, Sweden, Denmark, Germany, Russia, America, and others—we meet now with the same bright light. The paraffin lamp has, in fact, pushed aside the old dips, candles, and oil lamps; and the long winter nights of our northern latitudes have been rendered more cheerful since the introduction of these cheap lights. It is well known that the consumption of paraffin and petroleum oil has increased immensely in this and other countries during the last eight or ten years, and that the lamps constructed for the combustion of these mineral oils have now found their way into some of the most out-of-the-way places of country districts. When we remember how slowly people familiarized themselves with gas, and how many misgivings about its practical employment as a source of light had to be overcome, it is astonishing how rapidly this new illuminant has come into use. Why are these lights found more frequently in country districts than in towns—more often in the cottage than in the houses of the well-to-do people? We need not go very far to answer this question. It is on account of their cheapness, and the better light which they produce.

There are many people who strongly object to gas, even in these days of almost general consumption of this lighting material, and many who object more vehemently to the use of mineral oils. Both gas and mineral oils are possessed of a somewhat unsavoury odour; both explode under favourable conditions—*i. e.*, when mixed with air, and when a light is brought into contact with the explosive mixture. But, then, gas can be consumed from properly constructed burners without giving any smell; and mineral oils, when burned from suitable lamps, burn likewise with little or no odour. Petroleum oil has got into bad repute with people on account of the many shocking accidents by fire, arising from the upsetting of lamps, and the unscrupulous retailing of oils which inflame at low temperatures when they are brought near a light.

If I can show this evening that I have overcome, for the most part, these drawbacks to the use of mineral oils, by employing specially constructed lamps, and by a perfectly safe and novel mode of conveying the oil to the lamp and wick, you will, I trust, patiently forbear with me if I do not place the subject before you as well as its paramount importance deserves.

How to Convey and Distribute Oils.—It occurred to me that oils might be distributed like water over our houses, by availing ourselves of the law which applies to all fluids—viz., that they flow till they find their level or equilibrium, and that, by providing a small oil-tank in the upper part of the house, with pipes conveying the oil to the lower parts, any liquid illuminating material might be distributed with the same facility as water is now distributed over most modern-built houses.

In the place of plain taps, I regulate the flow of the oil by employing on each floor a little cistern or cisterns, provided with a well-constructed little tap, regulated by a ball-cock or self-acting float, and through which the oil must pass on its way to the lights. It is obvious that the lights must be, as nearly as possible, on a level with the distributing-cistern, and that the wicks of the burners which dip into the oil must be adjusted at such a height that they suck up the oil freely, without, however, causing any overflow; in other words, that the oil at the top of the wick is in a state of perfect equilibrium with the oil in the distributing-cistern, though the level need not be absolutely the same, owing to the slight friction in the conveying-pipes and the suction exerted by the cotton wick. When the lamp is lighted, the oil must, on the principle of the ball-cock movement, be supplied to the wick as fast as it is consumed, and with the most marvellous regularity. The light itself, in fact, is made to regulate automatically its own supply of oil. Having thus explained, in the briefest possible manner, the principle which guided me in the distribution of the oil to the lights, I will next proceed to explain to you in detail how this may be done practically.

Distributing Apparatus.—A small tank or reservoir is placed in the upper part of the house. It may be made of wood, lined with stout tinned iron or sheet tin, and covered in with a lid provided with a small opening for the admission of air, and for filling the reservoir with fresh oil whenever it is required. The capacity of the tank should be made proportionate to the number of lights that have to be fed from it. Its contents need rarely exceed one or two gallons. Over the outlet-pipe I fix a cage of fine wire gauze, which keeps back any dirt occasionally found in oil.

A pipe leads from this tank to the lower parts of the house. It may be car-

---

* Journal of Gas Lighting, vol. xix., p. 878.

† In the proceedings of the American Association for Advancement of Science, Salem meeting, I presented the matter referring to *Sugg's Gas Manipulation* in a different form, giving the results of the observations with his Argand burner in a tabular form as follows:—

Number of Observation.	Cubic Feet.	Observations Corrected by Old Rule. Candles.	Differences.	Uncorrected Observations.	Observations Corrected by Farmer's Theorem.	Difference.
1.	5·0	14·00	..	14·000	14·000	..
2.	4·9	13·78	0·22	13·504	14·060	0·556
3.	4·8	13·74	0·26	13·190	14·312	1·132
4.	4·7	13·30	0·70	12·502	14·148	1·646
5.	4·6	13·04	0·96	11·996	14·191	2·106
6.	4·5	11·93	2·07	10·735	13·255	2·517

The mean candle power of the 6th column is 13·99 candles; difference 0·01 candle.

The following will show the fractional power required to bring the uncorrected observations (column 5) to 14·00 candles.

2.—$4{\cdot}9^{1{\cdot}83} : 13{\cdot}504 :: 5^{1{\cdot}83} : 14{\cdot}00$ candles.
3.—$4{\cdot}8^{1{\cdot}47} : 13{\cdot}090 :: 5^{1{\cdot}47} : 14{\cdot}00$ "
4.—$4{\cdot}7^{1{\cdot}65} : 12{\cdot}502 :: 5^{1{\cdot}65} : 14{\cdot}00$ "
5.—$4{\cdot}6^{1{\cdot}86} : 11{\cdot}996 :: 5^{1{\cdot}86} : 14{\cdot}00$ "
6.—$4{\cdot}5^{2{\cdot}52} : 10{\cdot}737 :: 5^{2{\cdot}52} : 14{\cdot}00$ "

This table shows that the 3rd and 6th tests have not been good ones, while the 2nd, 3rd, 4th, and 5th tests fall a little below the square or second power, and the 6th test is considerably more.

ried along the waste-pipe, which is to be found in most modern houses. Branch pipes are carried to each floor. It is necessary to avoid lead or composition pipes, on account of the corrosive action which oils, especially vegetable oils, such as linseed, rape oil, and others, exert upon lead. Tin pipes are accordingly used for the conveyance of the oil.

The branch-pipe which conveys the oil to the little distributing-cistern may be fixed, like an ordinary gas-pipe, against the wall, either inside or outside the room, in the manner seen in the model before you. The distributing-cistern, of which I have here a model, consists of an open oblong box, about 6 to 8 inches long, 3 to 4 inches wide, and about 3 to 4 inches deep, into which the oil is delivered from a well-constructed stop-cock, which is soldered into the narrow side of the oblong box, and against which a somewhat smaller close box or oblong cistern is soldered, into which the oil makes its way from above by means of an inlet-pipe connected with the small box by a union joint. At about one-fourth from the top, inside the box, a very fine copper gauze is fixed. The oil, on passing through this sieve, is deprived of any accidental impurities, such as chips of wood, bits of straw, &c., which might otherwise make their way into the stop-cock and cause an obstruction. The hermetically closed box can be readily got at by unscrewing the union joint, which is at the bottom of the auxiliary reservoir, if it should ever become necessary to remove any accumulation of dirt. The stop-cock is large enough to deliver a large stream of oil, whilst at the same time the action of the self-acting float is capable of checking the delivery down to a drop or two every few minutes. The distributing-boxes can be made of all sizes, but as they constitute merely temporary resting-places for the oil, on its passage from the main tank at the top of the house to the burner or burners, they need not be made larger than is sufficient to hold a few ounces of oil. The china float is fixed to the tap by means of a metal arm or lever. The conical metal plug of the stop-cock may be either fixed by means of a screw-button, or simply by means of a metal pin. The float is set so as to shut off the flow of the oil automatically as soon as the box or distributing-cistern is filled to about 1½ inch in depth with oil. The china float is a circular double convex disc, pierced with a hole in the centre. Into this hole is fixed a piece of hard wood, to which the arm or lever is attached by a metal pin. The metal cone of the tap should work smoothly and regularly, and should be well ground in, so as to prevent any leakage whilst it is shut off. For better security, however, I fix a stop-cock just somewhat above the distributing-box, to shut off the supply when no oil is required from each floor. A stop-cock fixed in the main supply-pipe, just below the oil-reservoir in the upper part of the building, enables me likewise to shut off the oil from the house as effectively as gas can now be turned off at the meter.

It is obvious that the little distributing apparatus just described can feed one or two lights with the same facility with which it will feed 100 or more burners, provided they are all arranged on the same level, as seen in the model before you, since the tap will discharge the oil only in proportion as it is consumed. Burners placed at different heights must be supplied from distributing cisterns placed at corresponding heights. For single lights, such as street lights, railway lamps, &c., I have also succeeded in perfecting another system of conveying the oil to the wick, which answers most admirably, but which I am not able to submit to you to-night, as the experiments have not been quite completed, and as certain necessary arrangements have yet to be gone through.

Lamps and Burners.—The construction of the lamp or burner differs, of course, according to the kind of oil—vegetable or mineral—which it is proposed to burn, I have until now only used ordinary colza and rape oil as well as petroleum oil, but there can be little or no doubt that any vegetable as well as light or heavy mineral oil can be burnt on the same principle. The consumption of colza oil, rape oil, &c., is rendered so much more easy as the distributing apparatus renders the supply of oil to the wick as regular as clockwork, and gives a light which remains steady for a considerable time, say 24 hours, and which can only be influenced by the gradual charring of the wick. The petroleum oil light possesses in this, as in other respects, an important advantage over the ordinary oil light, in so far as the wick chars much more slowly, and rarely ever gets distressed. No lamp has as yet been constructed which gives the same amount of light during a lengthened period of combustion. Carcel's clockwork lamp gives a light of such uniform brilliancy, remaining unimpaired for several hours after the lamp has been lighted, that, in France, for instance, its light serves as a standard for determining the illuminating power of coal gas. It is known to burn remarkably steady after the first hour, and to preserve this constancy of combustion from six to ten hours. The very slight change observed in the light is owing to the uniform level and superabundant flow of the oil. The increase of brilliancy with the progressive burning during the first hour may possibly be accounted for by the decreasing quantity of heat withdrawn from the flame by the neighbouring parts, in proportion as these become warmer, and also perhaps by the excess of oil being too great at the commencement, and becoming reduced to the proper quantity by the decreasing tension of the spring employed for working the pump.

A perfectly uniform light cannot be obtained from ordinary lamps on account of their construction, and more particularly from the action of the wick; the variations, however, which occur in the intensity of the light, are confined within much narrower limits than in the case of candles, where a constant change is occurring. In many less perfectly constructed lamps the diminution of light during six hours amounts to one-third, one-half, and even four-fifths of the original intensity; it is only imperceptible in Carcel's and a few other lamps which produce their light with the least consumption of oil.

Upon what Principles should Lamps be Constructed.—There are four conditions required for a good lamp:—

1. A regular supply of oil to the burning wick.
2. Means for regulating and varying (within certain limits) the height of the flame.
3. The regulation of the current of air, according to the nature of the illuminating material and the quantity thereof which is to be burnt.
4. The oil-reservoir should be placed in such a position as not to throw a disturbing shadow into the illuminated space, without at the same time endangering the steadiness of the lamp.

All lamps may be divided, according to the methods adopted for feeding the wick with oil, into—

(*a*) Lamps in which the capillary action of the wick has to raise the oil from a lower oil level to the upper part of the wick; these are called *suction lamps*.

(*b*) Lamps which are provided with a mechanical (hydraulic) contrivance for carrying oil in smallest possible proportions and in constant quantities to the wick; these are termed *mechanical* or *pressure lamps*.

An ordinary light, with a floating burner, constitutes a suction lamp, in which the distance of the level of the oil from the top of the wick remains always the same. This most rational construction of a lamp cannot, however, be applied to lamps on an increased scale of construction, and is of use only for lamps which have not to be moved, and which have to produce only a weak light. Among the other suction lamps of a most simple yet faulty construction are the lamps in which the oil-vessel is placed sideways (as, for instance, in the ordinary kitchen or study lamp), or below the burning wick. In both kinds of lamps the wick suffers from an irregular supply, varying with the ever-changing level of the oil; they produce therefore a varying light. A more regular supply of oil to the wick can be ensured by constructing the oil-vessel upon the principle of the common bird fountain. The lamp requires, in fact, two oil-cisterns—an outer one, from which the burner is fed, and an inner or inverted vessel, from which the oil is supplied to the outer vessel in proportion as it is consumed. When the lamp has been lighted for some time, and the oil in the outer vessel has sunk below the mouth of the vessel, air-bubbles enter, and take the place of an equal bulk of oil, which makes its way into the outer vessel, thereby raising the oil level until the mouth of the inner vessel becomes again closed. In all lamps of this construction the height of the oil in the burner is subject to slight fluctuations, which produce, however, a perceptible variation in the supply of the burner, and, consequently, in the light produced by the lamps. Of other lamps, such as the so-called hydrostatic lamp, I need not speak, as they are little used now, having been found far too complicated and clumsy.

The ingenious mechanism in the different mechanical or pressure lamps, in which springs or pumps are made to force up the oil from the oil reservoir below the burner to the top of the wick, deserves to be admired. These lamps, known by the name of pump lamps, moderator lamps, Carcel's clockwork or mechanical lamp, convey the oil with almost faultless regularity to the burning wick. The moderator lamp, on account of its greater simplicity, its greater cheapness, and pleasing shape, has now, for the most part, replaced the Carcel lamp, in which the oil is raised by a Priest pump, so called after its inventor, set in motion by a spring which can be wound up. All mechanical lamps convey more oil to the wick than can be burnt, causing a constant overflow of oil—most ample in large lighthouse lamps. The wick can, therefore, be raised considerably above the edge of the burner. Thus less heat is conducted away from the flame by the metal burner, and the wick does not char so rapidly, whereby a more regular flow of the oil is secured—a condition which is all-important when heavy and less fluid vegetable or animal oils have to be burnt. The principle underlying all mechanical lamps—viz., the plentiful supply of oil to the wick, so as to cause a constant overflow, is inapplicable in lamps which are constructed for the consumption of mineral oils, such as naphtha, camphine, shale oil, photogen, solar oil, and paraffin oil. The principal condition which has to be complied with is a well-regulated and abundant supply of air, in order to consume the very large quantity of carbon which enters into their composition. To prevent smoke, it is also necessary that the wick should receive as little oil at a time as possible, and that this oil should reach the flame as hot as possible.

It is obvious that compliance with this latter condition renders the use of oils all the more accessible, which can only be burnt by a copious supply of air, deflected from both outer and inner air currents into the flame. This is done in various ways. In the so-called paraffin lamps the wick-tube is capped with a metal cone, which slightly rises above the level of the burner, and a current of air, as in the case of Argand burners, is often thrown into the inner side of the flame by means of a moveable button, the so-called Liverpool button. The air current is further regulated by glass chimneys of varying heights, according to the nature of the oil and the size of the flame. It is impossible to pay too much attention to the chimneys. I have found that one and the same burner produces as much as four times the amount of light when supplied with different chimneys. I also observed that the chimney influences to a very great extent the size or height of the flame, and that the latter is sometimes contracted and squeezed into pyramidical form by the chimney, whereby the illuminating power of the flame is materially reduced.

To sum up briefly this review of the different systems in use for conveying the oil to the wick, and the various lamps—at all events the more important ones which have been made—it will be clear that the lamps which are constructed on the most correct principles are at the same time of a highly complicated nature, and far too ingenious for every-day use; also, that mineral oils are burnt with greater advantage by a totally different system of constant oil supply, although I may mention that I have succeeded in constructing a moderator lamp which burns petroleum very nicely. I believe that the new method of feeding lamps with petroleum, proposed by me, has, at least, the merit of great simplicity, whilst it complies most rigorously with the requirements of a steady and uniform oil supply to the lights.

Improvements in Burners.—I have used both Argand and flat burners for the consumption of mineral oils in lamps, and have succeeded in what will probably astonish many gentlemen in the room familiar with lamps—viz., in burning the oil by means of the ordinary Argand burner and cotton wick dipping into the oil, without being inconvenienced by any overflow and dropping of oil, the wick projecting but slightly from the burner. This, you will agree with me, can only be done when the oil is supplied to the wick with the greatest possible regularity, and, *vice versâ*, it affords a clear proof that I have succeeded in so supplying it.

The difficulty of employing Argand burners for the purpose of burning light mineral oils is considerably increased on account of the more mobile nature of the fluid, and any overflow from the burners can only be prevented by the nicest adjustment of the oil supply.

The Argand burner is already such a perfect piece of apparatus that you will not expect to hear from me that I have materially improved upon it. I have been able, however, with the aid of Mr. White, of whose mechanical skill it would be difficult to speak too highly, to introduce several improvements in the construction of Argand burners for the consumption of petroleum oil, which enable me to employ burners of considerably larger size than have, I believe, hitherto been employed. By dispensing with the Liverpool button for throwing air into the inner part of the flame, the latter increases considerably in height giving a proportionately increased illuminating power.

The movement imparted to the wick by means of a worm, whereby the inner tube, or wick-holder, is worked from the outer gallery tube, which supports the glass chimney, by means of a pin fitted into the serpentine groove of the inner tube, usually entails a very unsightly breaking up of the flame into as many distinct divisions as there are brass stays, or rods, for connecting the outer with the inner tube, owing to the splitting up of the air-draught into several distinct currents. A perceptible loss of illuminating power is known to result from these defects; the burners are more liable to be influenced by air-currents, which often cause them to smoke most disagreeably. I have substituted fine connecting-pins between the outer and inner closely fitting tubes, and thereby entirely obviate these drawbacks to a pleasing and steady flame. This improvement applies equally to Argand burners used for burning colza or mineral oils.

The movement for raising or lowering the wick, known as the rack-and-pinion movement, which depends upon turning a key that works the pinion, was found to be defective, as the expansion of the metal tubes by the heat, and the contraction on cooling, played havoc with the most perfect fittings, and caused frequently a slight leakage through the hole in which the key works. In order to overcome this defect, I have placed the key above the level of the oil in the wick-tube, and have since found that no leakage need be dreaded from this cause.

I employ Argand burners of different sizes, burning wicks varying in diameter from ⅝ to 1¾ inch. It has, however, been found that the larger Argands give proportionally less light than the smaller sized burners, a ratio which is the reverse of that observed in the case of Argand gas-burners. This applies to the earlier experimental photometrical testings. I hope to overcome this loss of illuminating power, however, by employing central tubes, which deflect the current of air into the flame, whilst, at the same time, the quantity of air to the inner part of the Argand flame can be brought under thorough control. The proper conditions for any alteration of this kind can only be studied by patiently watching the effect produced, and I must, therefore, abstain from going further into this question, beyond mentioning that I am hopeful of constructing burners larger in diameter, with every prospect of success.

Theoretical Consideration of the Nature of Luminous Flames.—I found that the illuminating power of Argand burners, as well as flat lights, is considerably increased by an appropriate and well-adjusted supply of the illuminating material. It may be readily conceived that, with a mobile liquid like petro-

leum oil, which is easily vaporized, it is a matter of great importance to place the supply of oil to the wick at such a height as to allow the wick not only to suck up the oil freely, and to convey it without hindrance and with the utmost regularity to the wick, but to utilize also the heat engendered by the combustion of the oil, and which is communicated, to some extent, by conduction and radiation to the metal tubes in which the wick is encased, and in which the oil is supplied to the latter, in order to vaporize a portion—perhaps not an inconsiderable portion—of the oil before it comes in contact with the air supplied to the burner from the outside and inside of the flame. That this is actually the case may be seen when a light is allowed to burn for some time, until the wick-case has become heated to its maximum temperature, and is then suddenly blown out and rekindled after a few moments. The vapour of the oil is seen to burn above the burner, leaving a non-luminous dark space between the wick and the flame. Cold petroleum oil does not inflame, even when a light is held closely over the surface of the oil. It is, in fact, by this very test that the value of different samples of petroleum is determined. The point of ignition is observed by a thermometer, and no oil, the vapour of which inflames below a temperature of 90° Fahr., is now allowed to be sold, according to an Act of Parliament passed in the year 1868. It will strike you, as it struck me, that we arrive at the right condition for the burning of easily volatilizable oils, when they are vaporized previous to their introduction into the flame, and that a higher illuminating power is obtainable from the same illuminating material when conveyed to the flame in the form of vapour heated nearly to the point of ignition. Petroleum oil is, after all, not separated from coal gas by such an insuperable line of demarcation. The latter is a vapour at the ordinary temperature, and the petroleum oil which I use becomes converted into a vapour at the temperature of about 340° Fahr.

Moreover, gas engineers have shown us that the temperature at which coal gas is consumed materially influences its illuminationg power; that, for instance, gas which is conveyed through several miles length of gas-mains loses in illuminating power, on account of the condensation of the less volatile hydrocarbon vapours, such as benzole, naphthaline, and others, contained in the gas; that during cold weather the illuminating power of the gas recedes, and that the exhaustion of the coal in the retort-house cannot be carried so far as during warm weather. They are likewise aware of the fact that during the warm season of the year the gas remains more thoroughly charged with hydrocarbon vapours, rich in illuminating power, and that, consequently, a more thorough exhaustion of the coal is possible.

I may also remind you of the numerous ingenious devices resorted to by various inventors, from the late Mansfield, who was, I believe, the first to distil benzole on a manufacturing scale, down to the more recent enthusiasts in the cause of improving coal gas by charging it with hydrocarbon vapours—viz., the various so-called naphthalizing processes, with which most of you gentlemen are no doubt acquainted. We all know of the surprising effect which can be produced by passing coal gas through benzole, or some other more volatile hydrocarbon, and we also know how coal gas dislikes to be improved in this apparently simple manner. Attempts made on a large scale in the City of London, and in other places, have failed, owing to the difficulty of keeping the more condensable vapour in suspension in the gas. It is even possible—and a most ingenious lighthouse lamp has been actually constructed on this principle—to procure a beautiful light by merely passing air through very light mineral oils, slightly heated, and to burn the mixture of air and gas with splendid effect from a close Argand burner—if this name may still be applied to such an illuminating apparatus—by making use of the precautions observed in a Hemming's oxy-hydrogen jet. This shows, more than anything else, how closely coal gas and light hydrocarbon vapours are allied to each other, and how the same thing holds good for the one and the other under different conditions of temperature.

Every practical gas-burner maker is familiar with the influence which the temperature possessed by the gas when it issues from the burners exerts upon its illuminating power. One rule, I believe, is to allow the gas to issue under as low a pressure as possible, and a most ingeniously devised Argand burner has been constructed by an eminent gas engineer at the West-end, which burns the gas to the greatest advantage, but which hitherto has not passed out of the region of the gas-testing room (where I believe it is doing good service) into general practice, because the least draught of air causes it to smoke most inconveniently. Burners have been constructed also in which the flow of the gas is checked by wire gauze, cotton wool, &c., placed as near as possible to the point of issue of the gas. Metal burners get hot, and the longer the gas is retained in the heated part of the burner before it issues, the greater the illuminating power it produces. You are also, no doubt, familiar with the contrivance of placing a small piece of platinum into the flame of ordinary gas-burners, and we are informed, on the authority of Dr. Letheby, that the illuminating power of gas is increased 63 per cent. by this simple contrivance.

If, then, the illuminating power of coal gas can be improved by consuming the vapour at a higher temperature, or by charging it with easily vaporized hydrocarbons, it deserves certainly the serious attention of every practical lamp-maker, to study carefully how the same condition can be best complied with in the burning of mineral and other oils.

Now I think that the burners which I have the pleasure of exhibiting to you comply pre-eminently with these conditions. I may mention that I found this out only by carefully watching the influence which a lower or higher supply of oil had upon the flame. I was partly led to it also by endeavouring to realize a most necessary condition with which I felt that the new lights should comply—viz., that the burners should not discharge any oil. This is really not so easily attainable as may be thought at first sight, and I had no little trouble before I arrived at the right conditions. I found, however, on lowering the supply-pipe to the Argand burner an inch or more, so as to lower the level of the oil in the wick-case to the same extent, the illuminating power of the same burner was increased as much as 30 to 50 per cent., without entailing a corresponding increase in the consumption of petroleum. The fact was, that in one burner (the large size one) I discovered, on closely watching one day, that some vapour was issuing from a very fine hole just below the key, and that this vapour burnt when I brought a light near it. This observation proved that the petroleum vaporizes to a great extent before it gets to the top of the wick.

The theoretical explanation for this fact I found in an admirable lecture, delivered by Dr. Frankland, at the Royal Institution, June 12, 1868, from which I quote somewhat fully, as the evidence which Dr. Frankland brings to bear upon this interesting subject quite coincides with my own observation.

Dr. Frankland states that the source of light in a luminous gas or candle flame has been held by different chemists and physicists to be derived from "the ignition of solid matter in the intense heat developed by the chemical changes attendant on combustion."* It was thought that whenever hydrocarbons are imperfectly burned "there is a deposition of carbon, and this temporary deposition of carbon was said to be an essential condition for the production of the whole light required in an ordinary flame."† Another authority tells us "that the illuminating power of the gas is due to carbon particles, which are afterwards burned nearer the border of the flame."‡

Again we read: "That the brightness or illuminating power of a flame depends not only on the degree of heat, but likewise on the presence or absence of solid particles, which may act as radiant points. A flame containing no such particles is said to emit but a feeble light, even if its temperature is the highest possible."§

* Professor W. A. Miller. † Professor Williamson.
‡ Balfour Stewart. § "Watts's Dictionary of Chemistry."

Now this view, commonly held by scientific men, based upon Sir Humphrey Davy's researches, has been exploded by Dr. Frankland, who showed that there are many flames possessing a high degree of luminosity which cannot possibly contain solid particles. The flame of metallic arsenic burning in oxygen, for instance, emits a remarkably intense white light. Phosphorus burning in oxygen emits a dazzling light, surpassed by few other burning bodies, and is converted into phosphoric anhydride, a body which is volatile at a red heat, and it is therefore manifestly impossible that this substance should exist in the solid form at the temperature of the phosphorous flame, which far transcends the melting point of platinum.

For this and other reasons, to which I need not refer, Dr. Frankland considers that incandescent particles of carbon are not the source of light in gas and candle flames, but that the luminosity of these flames is due to radiations from dense but transparent hydrocarbon vapours, and it is to the behaviour of hydrocarbons under the influence of heat that we must look for the source of luminosity in a flame. These gradually lose hydrogen, whilst their carbon atoms coalesce to form compounds of greater complexity, and consequently of greater vapour density. Thus, olefiant gas ($C_2 H_4$) the chief illuminant in coal gas, forms naphthaline ($C_{10} H_8$), when the vapour density augments from 14 to 64. These and others are some of the dense hydrocarbons which are known to exist in a gas-flame, but there are, doubtless, others still more dense; pitch, for instance, must consist of the condensed vapours of such heavy hydrocarbons, for it distils over from the retorts in the process of gas-making.

Candle flames are similarly constituted. Dr. Frankland has also shown that a candle burns with feebly luminous light, under a low atmospheric pressure (on the top of Mont Blanc, for instance), and that jets of hydrogen and carbonic oxide, two gases which, at the ordinary atmospheric pressure, burn with little luminosity, burn with a markedly augmented light when burned in oxygen under a pressure gradually increasing to twenty atmospheres. If it be true, then, that dense gases emit more light than rare ones when ignited, as Dr. Frankland has conclusively shown, it follows that the vapour of hydrocarbons, such as those contained in petroleum oils (mostly homologues of marsh gas and olefiant gas, two of the chief constituents of coal gas), and which are much denser than these simpler hydrocarbons, fully account for the greater intensity of the light which these oils produce when burned in properly constructed lamps. That these oils can be burnt without soot, which, after all, is not elementary carbon, but always contains hydrogen, and that great luminosity is attainable without the presence of solid particles of carbon in the flame, is amply illustrated by the lights which I am able to exhibit before you. The difficulty to contend with is not so much how to burn the vapour of mineral oils, but how to prevent their volatilization in a more or less unburnt, or partially burnt, condition. Everybody is familiar with the unpleasant odour which so-called paraffin lamps do occasionally emit. This, no doubt, arises from imperfect combustion, for on first testing photometrically the light produced by the different size burners, it was found, in fact, that the larger size Argand burners, giving the light of as much as 40 sperm candles, consumed proportionately more petroleum than the smaller size burners. This was evidently owing to the passing of some portion of the oil in the form of unburnt or incompletely burnt vapour through the mantle of the flame, and as it was contrary to the well-established fact of gas producing a considerably increased illuminating effect when burnt in larger quantities than it produces when burnt in small quantities, I endeavoured to account for it by the theory so ingeniously advanced by Dr. Frankland.

Petroleum.—Since the years 1858 and 1859, extensive borings, for the purpose of obtaining petroleum or rock oil, were made in Pennsylvania and Ohio. In the former State, the most extensive and successful sinkings have been made between the Alleghany River and the western limit of the State. Along that river native springs of petroleum have existed, which, oozing through the superficial clay, have now formed a tenacious pasty mass. In the vicinity of these springs, the artificial wells have been made by sinking a bore deep enough to reach the thin layer of bitumen flowing between the strata. As the whole of this oil region is underlaid by what is known to geologists as the coal measures, the petroleum is probably derived from the natural separation of the bitumen from the carbonaceous portion of the coal, which, oozing upward from faults or fissures in the coal seam, drains off between the strata, and follows the inclination of the latter until it reaches the surface in some denuded portion of the coal bed. This gradual oozing over extensive surfaces yields a large supply of liquid oil, which has been extensively brought into the market, and has almost entirely superseded the mineral oils formerly distilled from bituminous deposits, liquid or solid, found in various parts of the world, among which the Burmese naphtha or Rangoon petroleum deserves special mention

The neutral oils distilled from bitumen, bituminous schists, coal, rock oil, &c., are composed of liquids having their specific gravity and boiling points so close to each other, that it is a matter of great difficulty to isolate them so as to examine their properties. But, although the photogenic oils derived from these sources are not always the same when viewed chemically, their photometric value may yet be precisely the same. According to the proportion of carbon contained in the oils, they require a more or less plentiful supply of air for their proper combustion, and the cotton-wick would probably be affected differently by heavier than by lighter oils. The oil which I usually burn is American petroleum of specific gravity ·795. It boils at about 340° Fahr., I have not had time as yet to test both lighter or heavier oils, but have no doubt that they can be burnt with equal facility by the apparatus before you. The wholesale price of the oil is 1s. 6d. per gallon. It is not difficult now to procure properly purified petroleum, and I have no doubt, if the demand for well-purified petroleum were to increase, that the distillers would find means and ways to thoroughly purify the oil used for burning in lamps.

Cost of Production of the Petroleum Light.—In determining the illuminating power of the different lights which it is my pleasure to exhibit to you this evening, I was fortunate in securing the help of Mr. W. Valentin, principal assistant in the Royal College of Chemistry, a gentleman who has had much experience in testing gas, and who gave me much valuable advice in elaborating the new system of lighting. I submitted two lamps for burning colza oil, and four lamps constructed for the consumption of petroleum, to that gentleman, together with the experimental model which you see here. The experiments were made at the Royal College of Chemistry. The illuminating power was taken by means of the well-known Bunsen photometer, and is expressed, as is usual in this country, in sperm candles, consuming 120 grains of sperm per hour. Each experiment extended over at least three hours, so as to counteract any slight error arising from the drawing off of the oil. The amount of oil consumed was carefully ascertained by weighing before and after each experiment. Petroleum oil of specific gravity ·795 was employed, one gallon of oil weighing 55,650 grains. The oil distilled between 340° to 350° Fahr. It can be obtained wholesale at 1s. 6d. per gallon.

Mr. Valentin has tabulated the results, and has, for better comparison, given in column 1 the number of sperm candles; in column 2 the number of cubic feet of common coal gas, price 3s. 9d. per 1000 cubic feet; in column 3 is given the hourly consumption of oil in grains; in column 4, the cost of oil consumed per week; in column 5, the cost of a corresponding amount of coal gas per week; and lastly, in column 6, the proportional cost of gas and oil.

The illuminating power of common London coal gas has been taken at 15 sperm candles for every 5 cubic feet of gas burned, although it is a well-known fact that the consumers gas-burners probably never burn the gas to equal advantage, and that 12 sperm candles may be said to represent the con-

sumers light more truly than 15; and that consequently my petroleum lights are 20 per cent. cheaper, in addition to the per centage shown in the tables. It is also a well-established fact that gas-burners consuming less than 5 cubic feet of gas per hour, such as the ordinary fish-tail burners most generally in use, do not produce a proportionate illuminating power; whilst, on the other hand, gas-burners consuming more than 5 cubic feet of gas give a proportionately better light. The pressure under which gas issues from the burners likewise affects its illuminating power most seriously.

For these and other reasons, to which I need not refer, such as differences in the burners themselves, &c., I have abstained from comparing with coal gas the smaller lights, giving less than 15 candles, and likewise the larger lights, giving considerably more than an ordinary 5-feet jet burner, and I prefer to rely, for the comparative numbers which I beg to submit to you, upon the petroleum lights which give equal to about 12 to 20 sperm candles.

I have already stated that the earlier experiments revealed certain defects in my burners, which, fortunately, I was able to rectify, and the table which embodies Mr. Valentin's experiments shows, therefore, a somewhat greater cost on the side of petroleum compared with that of gas (say from 10 to 20 per cent.), which I think would, however, be fully neutralized by the 20 per cent. loss of illuminating power which the consumer suffers on account of having to employ less perfect gas-burners, so that even these earlier experiments, set forth in the accompanying table, exhibited most encouraging results:—

TABLE I.—*Showing Illuminating Power of Original Argand Burners, consuming Colza and Petroleum Oil.*

DESCRIPTION OF LAMP. (Argand Burners.)	Illuminating Power Expressed in Sperm Candles.	Illuminating Power Expressed in Cubic Feet of Common Coal Gas equal 15 Candles.	Hourly Consumption of Oil in Grains.	Cost of Oil for One Week's Consumption of 42 Hours.	Cost of Gas at 3s. 9d. per 1000 Cubic Feet, for One Week's Consumption of 42 Hours.	Proportional Cost of Gas and Oil.
				s. d.	*d.*	
Colza Oil Lights.						
Lamp 1, consuming colza oil from an Argand burner, wick $\frac{1}{8}$ to $\frac{3}{16}$ of an inch	11·81	..	1203	2 9½	..	—
Lamp 2, with imperfect chimney, wick 1¼	3·98	..	532	1 2½	..	—
Ditto, with differently constructed chimney	15·01	5·0	1775	4 1	9·45	1 : 5·2
Petroleum Oil Lights, as originally constructed.						
No. 1 burner, size of wick $\frac{1}{8}$ to $\frac{3}{16}$ of an inch	15·67	5·22	864	0 11·8	9·86	1 : 1·21
Do. do. do.	15·47	5·15	787	0 10·7	9·73	1 : 1·11
No. 2 burner, size of wick the same (of French construction)	14·93	4·98	818	0 11·1	9·4	1 : 1·18
No. 3 burner, size of wick 1¼ of an inch	17·01	5·67	818	0 11·1	10·7	1 : 1·04
No. 4 burner, size of wick 1½ of an inch	33·85	..	2145	2 5	..	—
No. 5 burner, size of wick 1¾ of an inch	38·32	..	3433	3 10¾	..	—

Lights ranging from 15 to 38 sperm candles, of greater intensity than any other lights, promised sufficiently well to induce me to pursue the subject with every prospect of success, and when I again tested the lights, altered as the burners were in the meantime, I had the gratification to find that the illuminating power produced by the same burner was 40 to 50 per cent. greater than before. The accompanying table gives the results before and after the alteration of the burners:—

TABLE II.—*Showing Illuminating Power of Altered Argand Burners, consuming Petroleum Oil, as compared with Original Burners.*

DESCRIPTION OF LAMP. (Argand Burners.)	Illuminating Power Expressed in Sperm Candles.	Illuminating Power Expressed in Cubic Feet of Common Coal Gas equal 15 Candles.	Hourly Consumption of Oil in Grains.	Cost of Oil for One Week's Consumption of 42 Hours.	Cost of Gas at 3s. 9d. per 1000 Cubic Feet, for One Week's Consumption of 42 Hours.	Proportional Cost of Gas and Oil.
				s. d.	*s. d.*	
No. 1A burner, wick	14·0	4·66	602	0 8·18	0 8·8	1 : 0·93
No. 1 burner (original), wick $\frac{1}{8}$ to $\frac{3}{16}$	15·67	5·22	864	0 11·8	0 9·86	1 : 1·21
Do. 2nd experiment	15·47	5·15	787	0 10·7	0 9·73	1 : 1·11
Do. (altered)	23·24	7·74	795	2 10·8	1 2·63	1 : 0·738*
No. 2 burner (original), same size as No. 1 (of French construction)	14·93	4·98	818	0 11·1	0 9·4	1 : 1·18
Do. (altered)	21·52	7·17	788	0 10·7	1 1·55	1 : 0·79†
No. 3 burner (original), wick 1¼	17·01	5·67	818	0 11·1	0 10·7	1 : 1·04
Do. (altered)	28·0	9·33	1102	1 3·0	1 5·6	1 : 0·85
No. 4 burner (original), wick 1½	33·85	..	2145	..	..	—
Do. (altered)	46·5	..	2008	..	..	—
No. 5 burner (original), wick 1¾	38·32	..	3433	..	..	—
Do. (altered)	50·0	..	1965	..	..	—

* 35 per cent. cheaper than gas. † 27 per cent. cheaper than gas.

I have already explained that the alterations in the burners consisted mainly in the lowering of the oil level in the wick-tube. The same lights which hitherto had produced 15 candles gave now 21·5 to 23 sperm candles, without any increased consumption of oil, so that an increased illuminating power, to the extent of 40 to 50 per cent., was secured by this simple alteration, whereby the new petroleum lights compare now much more favourably with gaslight, rendering them, in fact, 20 to 30 per cent. cheaper than common coal gas; and if we take into account that at least 20 per cent. less illuminating power is produced from the consumers burners than what can be produced in the gas-testing room, I may say that the lights are 40 to 50 per cent cheaper than coal gas.

Hitherto I had only experimented with Argand burners. I next directed my attention to flat light, which can be trimmed so much more readily. I felt that it would be desirable to obtain small lights, giving about 4 to 10 candles illuminating power. I burnt the same petroleum oil in four different lamps, which you see before you, and determined the illuminating power of the light they produced.

I next placed the same flat-wick burners in a wick-case, which could be screwed to my model, and determined the light again, when an increased illuminating power of 15 to 20 per cent. was obtained. The following table contains the photometrical results:—

TABLE III.—*Showing Illuminating Power of Flat-Wick Burners, placed in Ordinary Stand-Lamps or Screwed to the Model.*

DESCRIPTION OF LAMP. (Flat Burner.)	Illuminating Power Expressed in Standard Sperm Candles.	Illuminating Power Expressed in Cubic Feet of Common Coal Gas equal 15 Sperm Candles.	Hourly Consumption of Oil in Grains.	Cost of Oil for One Week's Consumption of 42 Hours.	Cost of Gas at 3s. 9d. per 1000 Cubic Feet, for One Week's Consumption of 42 Hours.	Proportional Cost of Gas and Oil.
				d.	*s. d.*	
No. 1 flat wick, in lamp	3·56	..	..	..	..	—
Do.	4·0	..	215·0	2·92	..	—
Do., screwed into model	4·4	..	208·0	2·83	0 2·77	1 : 1·02
No. 2 flat wick, in lamp	8·5	..	409·0	..	..	—
Do., screwed into model	11·0	3·66	426·6	5·8	0 6·91	1 : 0·84
Do., 2nd experiment	11·2	3·73	448·5	6·09	0 7·05	1 : 0·86
No. 3 flat wick, in lamp	10·1	..	528·0	..	..	—
Do., screwed into model	15·26	5·08	598·0	7·8	0 9·6	1 : 0·812
Do., 2nd experiment	16·0	5·33	748·0	10·16	0 10·07	1 : 1·009
No. 4 flat wick, in stand-lamp of Bohemian glass	17·27	..	..	..	..	—
Do. burner, screwed into model.	20·06	..	..	..	..	—
Do., 2nd experiment	21·1	7·0	822·0	11·17	1 1·23	1 : 0·844

There can be no doubt that flat lights possess certain advantages over round or Argand lights, especially on account of the greater facility with which they can be trimmed; but it is impossible to obtain from them the same intense light, owing no doubt to imperfections in the chimneys. I therefore give the preference to Argand burners.

The cost of a flat light, taking Table III. for comparison, giving about 16 candles, is about the same, or slightly less than that produced by coal gas.

There remains now for me only to show you an ordinary table or study lamp of novel and perfectly safe construction, which gives a remarkably good light. I have not had time to ascertain photometrically what amount of light it gives, nor what its cost of consumption will be, compared with gaslight; but as I use the same size burner and same wick as No. 1 burner, described in Table II., giving the light of 23·24 candles, it promises to give a light which is cheaper than gas. This lamp promises also to become a useful adjunct to the microscope and spectroscope, as Mr. Highley, of 10A, Great Portland Street, assures me.

I have constructed, with the assistance of Mr. White, a railway lamp, which you see before you, both for rape and petroleum oil, giving the light of 8 candles for rape oil, and 6½ candles for petroleum, and the lights of which can be decreased or increased at will. I am not aware that petroleum has ever been burnt in railway lamps, although repeated efforts have been made. This lamp is a perfect success. It may be swung about in all directions without discharging any oil, and can be made to burn for 20 or more hours without requiring any attention. It also offers the advantage that the oil is placed in that part of the lamp which is above the outside roof of the carriage. The board of directors of the Great Western Railway, who warmly received my propositions for lighting up railway-carriages, gave me every facility of practically testing the new lamp.

It was placed in the guard's van of a night express train, and travelled all the way to Chester and back again, giving a perfectly steady light. The inspector testified to the above in a memorandum to me. I am also in treaty now with other companies.

I have not been able to ascertain the consumption of petroleum, but it is not difficult to foresee a considerable saving upon the railway lights, which consume vegetable oils, such as rape or linseed, if we glance at the relative proportion of the cost of colza oil and petroleum, when consumed from my new Argand burners, as set forth in Table I. Colza oil costs four or five times as much as gas, consequently there would be a saving of from 500 to 600 per cent. with the new lamp, whilst double or treble the amount of gas can be obtained if it be desired, which, I believe, will be hailed as a great boon by all night travellers on our great railway lines.

I may mention that the new burner can be readily placed in the railway lamps now in use without any material alterations, and that it requires very little trimming. I have burnt it for 22 consecutive hours without ever touching it. It can be turned off like a street-lamp.

You see before you a street-lamp, which is constructed on a similar principle to the railway lamp, and in which small or large lights may be burned with equal success. The mode of conveying the petroleum or rape oil to the burner from the oil-reservoir round the upper rim of the lamp ensures a perfectly steady supply, and the oil is consumed in the most economical manner possible. I am this evening burning No. 4 flat burner, which gives the light of about 21 candles. It will, of course, be necessary to await the results of further practical testings in the open before it can be said with certainty how it will turn out.

To show the practicability of my novel mode of conveying oils to burners, I have had constructed a chandelier, burning from one arm colza oil, from the other petroleum, and from the third coal gas, and have had it burning for weeks in my office with perfect success.

I may also mention that Sir Frederick Arrow, accompanied by the Elder Brethren of the Trinity House, came to my office to examine the new lights, at the instance of Dr. Tyndall—who was highly pleased with them, and who would no doubt have been here this evening, if he had not been called away to the shores of Northern Africa, to study the grand phenomenon of a total eclipse of the sun—and that I am commissioned to prepare burners for lighthouse purposes, for which I believe these lights of great intensity are specially adapted.

Now, gentlemen, the lights which I have had an opportunity of exhibiting to you this evening are merely in their infancy; many shortcomings, of which I am even now aware, I have been unable to remedy as yet, especially those connected with chimneys. I have not been able either to test various kinds of oil, either vegetable, animal, or mineral. What the infant will become when it grows into manhood I am unable to predict. This much I may say, however, even now, that the child promises well, and that it has already distanced its elder brethren, candles, lamps, and gaslight.

I may claim for the lights—

1. A perfectly regular supply of oil to the wick.
2. A pure and white light, superior in brilliancy to any light now in use.
3. Great steadiness of flame, which will cause them to become a boon to many engaged in the various manufacturing branches requiring a steady light. I believe them well adapted for counting-houses, type-setting rooms, &c.
4. Perfect safety from risks of explosion, as no air can possibly mix with the vapour of petroleum before it issues from the wick-case. I may mention that I had the inspectors of the principal insurance offices at my place of business in Wood Street to investigate the matter, and that they endorsed my insurance policies most readily, declaring the proposed conveyance of petroleum as safe as that of gas.
5. Great adaptability for all purposes of illumination where gas is now employed in private houses, public buildings, factories, railway stations, signal-lights, and street-lights.
6. Saving in cost of 500 to 600 per cent. upon colza oil, and 40 to 50 per cent. upon that of common coal gas, reckoned at 3s. 9d.

From all these considerations, I am inclined to think that the new light will be especially adapted for country districts where no gas can be had, and to places where gas is much dearer than in London. The supply of mineral oils may be said to be plentiful, and a new source of illumination is, therefore, provided, which will become a formidable rival to coal gas.

I am painfully aware, gentlemen, that I have scarcely done justice to the all-important subject of burning mineral oils—the liquid gas which nature has provided for us. To-morrow, some of our most eminent men of science will be engaged in investigating the nature of the universal source of light—the sun—with all the appliances of modern science. Now, when we come to think how little we know about this great source of light and heat, you will forbear with me if I have but imperfectly brought before you the nature of the artificial light, the light which mineral and other oils are capable of producing when properly burned.

Discussion.

Mr. Silber, in answer to a question, explained that the table-lamp exhibited was constructed on the theory propounded by Dr. Frankland—viz., that oil which was burnt at a certain degree of heat produced a more brilliant light than it would if simply brought up to the top of the wick by suction in the ordinary way. There were two principal points to be aimed at, to ensure perfect combustion in a lamp with petroleum oil—first, that the mass of oil should remain cool; and, secondly, that a small portion of it just below the wick should be nearly, if not quite, at boiling point. He had effected this in the lamp before him, and in fact some of the oil was consumed almost, if not quite, in the shape of vapour. The wick went down nearly to the bottom. The arrangement referred to prevented the oil flowing out of the lamp, even if upset; the lamp being of metal throughout, would also not break.

Dr. Wylde said he believed that petroleum oil lamps had been tried for some time in railway-carriages, but it was found they were subject to the objection that suddenly slamming the door of the carriage would extinguish the light, and also that the lamp-men complained that they took three times as long cleaning as ordinary lamps, and he would like to know whether this objection had been met.

Mr. Silber said, speaking from the limited experience which had yet been obtained, neither of the evils alluded to had been found to arise from his new lamp.

Mr. Hartley said it had been stated that the use of these oils would effect a saving of from 30 to 40 per cent. as compared with the use of gas, but he supposed this was calculated on the present price of petroleum, and apprehended that if it came into common use instead of gas, the increased demand would occasion an increased cost. A comparison was also drawn between the lights obtained from burners used by the public generally and the burners used for testing, and it had been stated that the light obtained was considerably in excess of that required by the public. That might be so when measured by such lamps as were now exhibited; but he believed that what the public really wanted was a light of from 8 to 12 candles. Much as he admired the ingenuity displayed by Mr. Silber in the construction of his lamps, and in the apparatus for supplying houses, he could not think it was a system which would recommend itself to the public who could get gas. In the first place, cisterns must be provided, which would necessitate keeping a large stock of inflammable oil on the premises, which was open to considerable objection, while in the case of gas, you had simply to turn it on or off as required. Then, again, with oil lamps of whatever character, there was not only the trouble of attending to the lamps, adjusting them at proper times, but of trimming the wick, and in any estimate of the relative value of a particular mode of lighting, this time and trouble ought to be taken into account, which did not seem to have been done in the present case. Although he was interested in gas lighting, he had no wish to disparage any new system, knowing that improvements must be likely to arise in the mode of lighting; but some little difficulty seemed to be attached to the regularity of supply by means of these cisterns, and he thought any one who had had experience of ball-taps—and there were few who had not—must at some time or other have found them to fail, very often by having their houses flooded with water. In these cases, moreover, they were acted upon by a much greater pressure than would be necessary in the small supply-cisterns referred to by Mr. Silber. He saw by the diagram on the board that provision was made for an overflow, but in such a case, of course, there would be waste and expense.

Mr. Silber said there would be no waste, as the overflow-pipe went into a safety-box at the bottom of the house. In reply to another gentleman, he said that the oil would flow through the smallest pipes that might be required in colder weather than had been known in this country for the last fifty years.

Dr. Dresser said when he first entered the room he perceived the unpleasant odour which was always noticed when any kind of mineral oil was being burnt. To him it was very offensive, as it always gave him a headache, and for that reason he objected to sit in a room which was lighted with petroleum. There was another thing, which was the standing difficulty with all the lamps he had yet seen which were lighted by any fluid, and that was the attention required in keeping them in order. His servants might, perhaps, be inferior in capacity to those of other persons, but, at any rate, they seemed to lack the power of regulating the wick in moderator or any other lamps, and, when this devolved upon himself, it became very tiresome. If anything in the shape of an incombustible wick, made of asbestos, or any substance of that kind, could be devised, it would remove one great objection. Gas had a great number of advantages, one especially being the power of turning it on and off at a moment's notice. It certainly did not give so good a light as that afforded by mineral oil, as he had proved in his own experience. He had procured an experimental lamp, which he used in his own study, and which was so constructed that he could introduce a carburetting material such as coal-tar naphtha; and when the gas passed over this carburetting substance and became surcharged with carbon, a very great brilliancy was added to the light—in fact, a very similar class of light was produced to that shown in some of Mr. Silber's lamps. There was also this advantage in such a lamp, that the supply needed renewing but very seldom, the vapour only being consumed; indeed, half a pint of this carbonizing material would last probably three months, or even longer. One disadvantage of this method, however, was that the more carbon that was introduced into the flame the more was the smoke that was produced, and as he was concerned specially in fine arts, and a great deal in decorated rooms, he was strongly opposed to smoky lights of any description, because they damaged decorated ceilings, walls, and valuable paintings. He noticed that if he carbonized his light he got an increase of smoke, and also that offensive odour which he had previously spoken of, and for that reason he was obliged to discontinue even the carbonizing of common gas. Of course a leakage of gas was attended with an unpleasant odour, and it would be the same with mineral oil, and in each case there would be the danger of explosion, which, probably, would be equal; but there would be the additional disadvantage in the case of mineral oil, that, it being of a greasy nature, the walls and carpet might become seriously injured. It appeared to him that this plan was best adapted for railway lamps, if draughts did not affect them, and he also thought it might advantageously be applied to small towns and villages, where gas-works were almost out of the question.

Mr. Highley said that, on hearing of this improved lamp, he had called on Mr. Silber, who was entirely unknown to him, and expressed a desire to try how far it would be applicable to scientific purposes, especially for the microscope, for the ophthalmoscope, and for the magic-lantern. Mr. Silber very kindly placed at his disposal a lamp similar to the one on the table, and for the last two or three weeks he had been using it constantly every night. He was happy, therefore, to give his testimony to the fact that there was no unpleasant smell whatever arising from it when properly used. On the second night of trying it, when using it in his bed-room, he found an unpleasant odour, but it arose from its being turned down too low; but, if properly adjusted, there was neither smell nor smoke. He had had considerable experience of paraffin lamps, naphthalized gas-burners, and, indeed, he had tried nearly every form of lamp in the market, and his opinion was that this was the most perfect he had yet seen, and admirably adapted for lighting fine art galleries, from the purity of the flame. If a silver spoon were held over it it was not discoloured, as would be the case with gas. The magic-lantern was every year coming into more general use for educational purposes, and it was a matter of great importance to obtain a pure and brilliant light, which could readily be brought into play for such purposes. Originally oil lamps were used, but they did not give so good a light as could be desired, and of late years paraffin had been tried; this gave a beautiful light, but there was this great disadvantage, that it gave off a vapour which affected everything with which it came in contact; the lantern itself became saturated with a kind of greasy fluid; and whenever it was relighted the peculiar odour belonging to paraffin oil, which was by no means agreeable, was strongly apparent. In consequence of this he had tried paraffin wax, which gave a very brilliant light, and was also free from smell and grease; but there was this drawback, that it required to be melted before use, and in the case of a lamp of considerable size, where there was a large mass of the material, this took a great deal more time than was always convenient. He had also used naphthalized gas, which gave a very brilliant light; and ordinary gas used with what was called the "London" burner, which had an adjustable cone, also answered very well; but after trying Mr. Silber's lamp for three weeks, he gave it the preference over anything he had tried. The light was peculiarly white, resembling in character the lime-light, although of course not so penetrating, and it was certainly the purest light he had met with. With regard to the trimming of the wick, he could only say that, during the whole of the time he had been trying the lamp, he had not had occasion to change the wick at all. It burned very slowly, and there was still enough left for more than three weeks longer. Therefore, for scientific purposes, he thought this lamp was just the thing which had been long desired, and as a household lamp it was certainly the best he had seen, giving a peculiarly soft light, which was very pleasing; in fact, his wife was perfectly delighted with it.

Mr. David Chadwick, M.P., congratulated the society on the valuable and interesting paper which Mr. Silber had read. He said the lamps exhibited told their own tale, and clearly showed what a vast improvement had been made in the mode of dealing with mineral oils for lighting purposes. With regard to the paper itself, he said he should have regarded it as more perfect had the author given a little more detailed information with regard to what had been done by previous inventors, in order to show in what state the subject was when he took it up, and what were the specific improvements he had made. He (Mr. Chadwick) had had some twenty years experience in the management of gas-works, and had also had opportunities of seeing all the ingenious American contrivances for burning petroleum oil, and had brought over, some years ago, from that country, a small lamp, costing about 6d., which appeared to him to give as brilliant a light as those now exhibited, although no doubt it had many defects. He did not question the estimate made by Mr. Silber of the relative value of his lamps as compared with lamps burning colza oil, or with gas-burners, but he would venture, as one having had some experience in the matter, to recommend him not to trouble himself too much about working out a comparison with gas, for, wherever gas could be supplied, he was quite sure that no improvements in any lamps for burning oil would ever supersede it. There were, he might almost say, hundreds of advantages in the use of gas beyond those already mentioned, and this he said with the most perfect independence, as he had now no connec-

tion in any way, direct or indirect, with gas manufacture. On the other hand, there were thousands of villages, not only in England but throughout the world, where light was wanted, and if they could only see their way to getting it at a cheap rate, there would be plenty of occupation for any amount of ingenuity in supplying them. He must venture to question what had been said by Mr. Hartley about the public only requiring a light equal to 8 or 10 candles. He had been connected with gas-works which invariably gave 20 to 22 candle gas, and if their customers had a less illuminating power, he knew they would very soon complain. His experience was that the public required the best light they could get, and, were it not for the extra cost of cannel coal, they would insist upon having a better article than was now supplied to them. At any rate, he was quite certain that 8 or 10 candle gas would not be tolerated in London. Most gentlemen present probably had felt the inconvenience of the miserable light afforded by railway-carriage lamps, and as he travelled on the average about 200 miles per week, a great deal of which was after dark, he could speak feelingly on the subject, for he was constantly annoyed by the abominable state of the lighting in railway-carriages of almost every line in the kingdom, which was a disgrace to every railway engineer. You might spoil your eyes by attempting to read, but it was to little purpose, for the light was so arranged that it hardly illuminated anything but the top of the carriage. Indeed, he had been in the habit for years of carrying a railway candle-lamp, but that was an inconvenience which passengers ought not to be subjected to. He ventured to say, therefore, that a large fortune was within the reach of any one who would bring forward a thoroughly good lamp which the railways would adopt, and which would answer railway purposes as well as those now exhibited, for shareholders and the travelling public would soon force directors and slow-coach engineers to adopt it. He did not apprehend there was much danger in burning petroleum, but even in ordinary lamps there was sometimes a danger little thought of. Only in January last he was returning from America, and had in his cabin an ordinary spring candle-lamp. On one occasion he left it burning, and on returning in the course of an hour he found that the spring had forced the candle out, and deposited it on his bed, so that it was almost a miracle that the whole ship was not set on fire. An objection had been raised by a previous speaker that the price of petroleum would probably rise in case of a greatly increased demand, but he did not apprehend this would be the case by any means. He knew something about the quantity of shale in this country capable of producing mineral oil, had personally visited nearly all the oil-wells in Oil City, in Pennsylvania, and had seen the sources of supply both in Canada and the United States, and it was a curious fact that the price within the last six months had been about half what it was some few years ago, notwithstanding the enormously increased consumption. There was no fear, therefore, of the price being so increased, and no one need be deterred from prosecuting any improvements which would lead to its more general adoption for lighting purposes. In villages, houses, shops, and railway-carriages there were a thousand ways in which such an invention would be found to be of enormous benefit to the public, and if so, then of course to the inventor, without interfering with gas, which he did not think would ever be superseded by any such arrangement as that proposed.

Mr. PETERS said the principal merit of Mr. Silber's invention seemed to consist in his obtaining more perfect combustion; and if this could be ensured, all the unpleasant odour which was so objectionable in the case of mineral oils would be removed. There could be no doubt that a vast amount of petroleum was being consumed in very badly-constructed lamps; this, probably, was the cause of the complaints which were made of the smell, for he had not noticed anything of the sort in connexion with the lamps exhibited by Mr. Silber. Petroleum had been applied to manufacturing purposes in connexion with steam, but its cost stood in the way of its extensive application for such purposes. In the present case, however, as far as he understood it, the lamp itself, while burning, effected the vaporization of the oil, the wick-case being so arranged that only as much oil was admitted as could be totally consumed. This seemed the principal merit of the invention, the rest being mere manufacturing detail.

The EDITOR of the "IRONMONGER" asked how Mr. Silber proposed to construct his reservoirs, so as to avoid any danger of explosion, in case of a house catching fire. He also asked to know if there were any improved method of trimming lamps for domestic purposes, for all persons knew that this was a delicate matter, especially in the hands of careless servants. If railway-carriages were supplied with petroleum lamps, he feared there would be very lamentable results in case of accident, which in these days ought to be considered. He also asked if any means were adopted to ensure the flow of vegetable oil through the narrow pipes in frosty weather.

Mr. FORDRED said he had noticed the specific gravity mentioned as that of the oil used in the experiments referred to was ·795, which was exceedingly light, even for the best American petroleum, the average being ·800, whilst the majority of oils made from shale had a specific gravity of ·810 to ·820. Now, as the gravity rose so did the tendency in the oil to carbonize the wick, and the necessity for frequently renewing it. If only the lighter oils were used, of course the difficulty would be obviated, but he had hoped to have seen some lamp exhibited which could burn what was known in the trade as "intermediate" oil. In distilling both petroleum and paraffin oils, the lighter portion could be readily burned in the ordinary lamps, and the heavier was used for lubricating purposes, but between the two there was generally about 20 per cent. of what was known as "intermediate," which the distiller had great difficulty in utilizing. He must say that the system of laying on oil for lighting purposes in houses was not a new one, as it had been practised for many years in America, especially in the Southern States. Some years ago, he was visited by a gentleman from New Orleans, who told him that it was a common practice for houses to be fitted throughout with pipes for supplying illuminating material to lamps; this was before the discovery of petroleum, the fluid used being a mixture of turpentine and spirits of wine. There was always, however, a difficulty in such cases in keeping the joints tight, because a tap which would be perfectly secure under the pressure of gas would not remain tight with liquids. It would have been very useful if a comparison had been made of the results obtained by burning oil in these improved lamps and in those in ordinary use in the trade, the comparison with gas being of very little use, as the two could never compete.

Mr. SEYMOUR TEULON said the railway lamp exhibited by Mr. Silber certainly gave a better light than those in ordinary use in railway-carriages, though not equal to the gaslight on the Metropolitan Railway Company's line. It must, however, be borne in mind, in considering the use of hydrocarbon oils in railway lamps, that railway accidents unfortunately happened, and as there would be a separate supply of oil in each lamp in the train, there would be so many sources of additional mischief. That appeared to him a great objection, which must on no account be lost sight of.

The CHAIRMAN, in proposing a cordial vote of thanks to Mr. Silber, said he would not detain the meeting by any remarks beyond saying this—that he thought the inventor of these new lamps would do well to follow Mr. Chadwick's advice, and confine himself to those openings where gas could not easily be introduced. He had travelled in many parts of Europe, and there were thousands of places, not only in England but on the Continent, where an improved mode of burning these hydrocarbons would be of the greatest possible public benefit, and of course equally to the benefit of the inventor and patentee if he introduced it.

The vote of thanks was carried unanimously.

Mr. SILBER, in reply to the various observations which had been made, said he felt deeply grateful for the patient hearing which had been afforded him, and for the opportunity which he had had of listening for the first time to all the objections which could be made by various minds to his system of lighting. Many of these objections, however, had been answered by other gentlemen. For instance, Mr. Hartley feared that petroleum would rise in price if the demand were much increased, while another speaker of great experience at once threw over the idea. Another gentleman had expressed a doubt with regard to the safety of keeping a stock of petroleum in the reservoir, but as he had stated in the paper there would be no occasion for more than two gallons at a time to be kept in the house; and he believed that if this system ever came into active use, the oil would be brought to the door as regularly as other necessaries. The ordinary ball-cock in water tanks had also been alluded to, and difficulties sometimes arose from its irregular action; but he invited inspection of the float and stop-cock he had introduced, which, he believed, would work for a number of years—in fact, as long as the metal lasted—without derangement, and he thought this was one of the principal merits of his invention. Other gentlemen had referred to the offensive odour given off by petroleum in the ordinary lamps, but as he had shown that by the improvement of the burner a greater light was produced with less quantity of oil, using the same oil, the same wick, and the same sized burner, it would be evident that there must be more complete combustion of the petroleum, and therefore the offensive smell would be got rid of. This had been effected simply by lowering the level of the oil, so that only the necessary quantity of oil came to the wick instead of its being saturated in excess, which was the cause of the offensive vapour being thrown into the room instead of being consumed. By this means he had produced with the same burner, oil, and wick, a light equal to 25 candles, whereas before it had only been equal to 15 candles. If he had read the figures from the tables, which he had omitted to do for the sake of brevity, every one must have admitted that they were the figures of a man of business. And with regard to the correctness of these figures, he would only say that Mr. Foster, the secretary, had given the name of Dr. Frankland as the best authority in England on such subjects, and on applying to that gentleman, he had introduced him to Mr. Valentin, who had made the experiments and made the calculations, the results of which were shown in the tables. No higher testimonial could be given by one scientific man of another than that given by Dr. Tyndall to Mr. Valentin, for, after expressing his real satisfaction with the lamp, he said that if Mr. Valentin had prepared the figures they were sure to be correct, and might be thoroughly depended upon. With regard to ill effects on ceilings, pictures, &c., he need not refer to any other authority than his own observation, for he had had these lamps giving more than 300 candle lights in his own warehouse from nine in the morning until eight at night, and had not yet discovered the slightest trace of black deposits on white bodies, consequently they did not damage the ceiling. From conversations he had had with scientific gentlemen he believed they were under the impression, although he would not state it as a fact, that pictures would suffer little or no damage from the use of these lamps. With regard to the trimming of the wick, the fact of having the fluid always at the same level prevented any pressure upon the wick, and he had burned one wick for 72 consecutive hours without trimming, using mineral oil. Any danger from fire was obviated by having a stop-cock, which would shut off the entire supply, and any waste from overflow was avoided by having the waste-pipe connected with a receptacle 12 feet below the bottom of the house, or in the garden, where also in case of fire the whole of the oil could be transferred in two minutes or less. In the case of railway lamps, the reservoir of oil was placed outside the carriage, which would prevent danger, and his lamps were also constructed for rape oil (which was in fact being burned in one of the specimens exhibited), which would prevent any explosion. The system of burning the oil and the burners in the railway, street, and house lamps were each and all constructed on different principles, and were under different patents. He believed that full statistics would be found in the printed tables, and concluded by expressing his acknowledgments for the vote of thanks which had been passed.

PROFESSOR TYNDALL ON THE WATER SUPPLY OF LONDON.

At the Royal Institution, on Friday Evening, Jan. 19, Professor TYNDALL delivered a Lecture upon the "Scattering of Light," which was, in point of fact, a discourse upon domestic water supply. The learned professor commenced by exhibiting the impurities of London air, the motes of a sunbeam, by the light of the electric lamp, and explained to his audience that what they saw was not air, but suspended particles, capable of being dissipated or removed, and that, when so removed, the track of the beam through the air itself would be invisible. He next related that he had accompanied the eclipse expedition to Oran, and that on his return, having been disappointed as regards the special object of his journey, he had sought to turn his opportunities to account by investigating the causes of the varying tints presented by sea water. He described the way in which a series of 19 bottles had been filled between Gibraltar and Spithead, and the results of an examination of them by the electric light. The bottles were themselves on the table, but were not placed in the beam before the audience, since the original differences among them had been diminished by subsidence. The general tendency of the examination was to show that the yellowish water of coasts and harbours held in suspension a large quantity of particles; that the particles in the green water were less abundant and in finer division; and that the blue water of the deep ocean was comparatively free. Professor Tyndall explained the blue or even blue-black of the depths, by displaying the prismatic spectrum on the screen, and by quenching it, at first partially, and with regard to certain colours, and afterwards absolutely, by a succession of cells of increasing thickness, containing a solution of permanganate of potash or of sulphate of copper. He said that when a beam of light entered the sea, the heat rays were absorbed by the surface, the red rays by a very superficial layer of water, the green rays next, and ultimately the blue. If, however, the light encountered particles, these would reflect the green rays to an observer; while, in the absence of particles, the green rays would continue their course till they were wholly quenched. Water of great depth and absolute purity would thus appear entirely black, like a sea of ink, and would reflect no light beyond a glimmer from its surface. The professor exhibited a white dinner-plate, to which a rope was attached, and which he was in the habit of having cast overboard and towed from the *Urgent*, and which always appeared green, and he also described the appearances seen on looking down the screw-well of the ship, so that the water was seen by turns green—with the screw-blades as a background—and then dark blue, with the ocean depths for a background. The white plate, which appeared as a green object when towed under water, would, he said, if ground to powder and scattered, cause the portion in which this powder was suspended to return a general green reflection. Having in this way established that the visibility of the track of a beam through water depended upon particles by which the light was reflected, Professor Tyndall next placed before the electric lamp a succession of nine bottles, containing samples of the water supplied to their customers by the various London water companies. The turbidity revealed was in every case sufficient to make the audience regard water as a very undesirable beverage. That of the Lambeth Company displayed pre-eminence of a bad kind; that of the Kent Company was by far the clearest; the West Middlesex Company stood second in order of merit, and among the rest there was little to choose. With a reticence more eloquent than words, the lecturer avoided expressing opinions about the dirt that he exhibited; and he also expressly mentioned that pellucidity was no proof of the absence of soluble impurities. He also showed that to cleanse water from suspended dirt was a very difficult matter; and exhibited four specimens of distilled water, a specimen once filtered by Mr. Lipscombe, a specimen that had gone through a silicated carbon filter, and a specimen four times filtered through bibulous paper in the Royal Institution Laboratory. These were clear when compared with the water of the companies, but the track of the beam was plainly visible in

all. A specimen of water from the Lake of Geneva was then exhibited in illustration of great natural purity, and here a faint blue line only could be seen. This brought Professor Tyndall to the practical conclusion at which he had been aiming—namely, to an account of the water supply yielded by the English chalk formations. He characterized this as being of the greatest attainable purity, inexhaustible in quantity, and easily accessible for the supply of the metropolis. He described its natural hardness as being such as to render it unfit for domestic use, but explained that by Clark's process this hardness could be entirely removed at the central works, and that the water might be delivered in London at a uniform temperature, free from organic impurity or suspended particles, and so soft as to be perfectly adapted for all household purposes. He described Clark's process, and illustrated it before the audience, and finally showed actual results by producing a bottle of water from Canterbury, derived from the chalk, and softened in the manner described. By the side of this was a similar bottle containing the water supplied to the Institution, and the two were illuminated together by way of contrast. The difference was like that between pea-soup and crystal. Professor Tyndall then read a portion of the report made some years ago by the late Professors Graham and Miller, and by Professor Hofmann, upon the admirable qualities of this chalk water, when artificially softened, upon its fitness for the supply of the metropolis, and upon the impolicy of allowing it to pass into private hands, and concluded by saying that every word that he had read he desired fully and cordially to endorse.

Dr. Whitmore's Report on the Quality of the Gas supplied in St. Marylebone, in December, 1870:—

December, 1870.	Illuminating Power in Sperm Candles.			Mean Pressure in Tenths of an Inch.		Mean Quantity of Sulphur in 100 Cub. Ft.	Mean Quantity of Ammonia in 100 Cub. Ft.	Sulphuretted Hydrogen.
	*Mean of 22 Obser.	Highest.	Lowest.	Highest.	Lowest.	Grains.	Grains.	
Imperial Company's gas	16·69	17·27	16·04	26·56	10·80	30·35	2·83	None.
Chartered Company's common gas	16·35	16·98	15·97	33·11	13·71	27·99	2·83	None.
Chartered Company's cannel gas	23·01	24·24	22·65	29·17	13·45	27·15	1·83	None.

Mean of daily readings of barometer . . . 29·69
" " " thermometer . . . 47·37

* Each observation consists of 10 readings of the photometer, at intervals of one minute.

The mean illuminating power of the Imperial gas during the month was equal to the light of rather more than 16½ sperm candles; it ranged between 17·27 and 16·04 candles, and on 19 occasions it exceeded 17 candles. The amount of sulphur in 100 cubic feet varied from 28·11 to 33·50 grains, and the ammonia from 1·0 to 4·75 grains; the larger amount of ammonia was found on the 8th and 15th of the month. The mean light of the common gas of the Chartered Company was equal to that of 16·35 candles; it ranged between 16·98 and 15·97 candles. The mean quantity of sulphur impurity amounted to 27·99 grains, and of ammonia to 2 83 grains. The mean light of the cannel gas was equal to that of 23 candles, but on 15 occasions it was slightly below the legal standard; once it exceeded 24 candles. The mean amount of sulphur and ammonia in this gas was, of the former, 27·15 grains, and of the latter, 1·83 grains. On no occasion was sulphuretted hydrogen detected in either of the gases, and in all of them the pressure was satisfactory. The above results were obtained from the gas manufactured by the Imperial Company at their Fulham works, and from the Chartered Company's gas, manufactured at their works, Horseferry Road, Westminster.

Dr. Whitmore's Report on the Quality of the Water supplied in St. Marylebone, in December, 1870:—

December, 1870.	Total Solid Matter in degrees or grains per Imperial gallon.		* Loss by Incineration of Solid Matter in previous column.		Ammonia.
	Dec., 1869. 0°	Dec., 1870. 0°	Dec., 1869. 0°	Dec., 1870. 0°	0°
Distilled Water					
West Middlesex water	19·04	18·96	0·70	0·74	—
Grand Junction water.	19·28	18·96	0·72	0·78	—

* The loss by incineration represents the amount of organic and other volatile matters contained in an Imperial gallon (70,000 grains) of water.

Dr. Frankland's report on the quality of the water supplied by the different London companies during December shows that the West Middlesex Company's water, as drawn from their mains, contained less total solid impurity than that of any other company, and it is this water that is supplied to nearly the whole of the parish of St. Marylebone; but it is interesting to notice that, by means of Clark's softening process, the total amount of solid impurity contained in the water of the Grand Junction Company was reduced from 28·84 grains, in every 100,000 grains of water, to 14·10 grains—a process which has the effect not only of largely precipitating the hardening salts contained in all water supplied to the metropolis, but of reducing also the quantity of organic matter. Water thus softened and purified is undoubtedly much to be preferred for all culinary and domestic purposes, and especially for washing linen, &c., which, as Dr. Frankland observes, it cleans without the use of destructive chemicals. It would, I think, be very desirable that the public should have some information as to the probable increase in our present water-rates which the application of Clark's process to the entire water supply of London would entail. It must be remembered that the average daily water supply to the metropolis is 98,000,000 gallons, and in order to purify this enormous quantity of water no inconsiderable cost in machinery, material, and labour would be incurred; still, if the thing be practicable, and at the same time no material addition to the water-rates would be made, the advantages that would result to health and social comforts would fully justify its adoption.

Gas-Works in the War.—The Munich *Journal für Gasbeleuchtung* for January gives a lamentable account, illustrated by a photograph, of the damage done to the gas-works at Strasburg during the bombardment. The picture is deplorable. A large gasholder in the foreground is riddled with holes, large portions of the tank-plates are torn away, and the columns and fittings are thrown about the yard in all directions; the retort-houses are unroofed, and the chimneys thrown down. It took two months and a half of hard work, after the capitulation, to put the establishment in a condition to light even a portion of the town. The works belong to the Continental Union Gas Company, but we are not told who pays for the damage. The editor naively remarks: "We hope this will be the first and the last gas-works *on German soil*, that will give us the opportunity of presenting such a picture." Many other gas-works have suffered by shortness of coal, owing to interference with the communication.

Analysis of the Loch Turret Water.—The following is a copy of Dr. Stevenson M'Adam's report to the Crieff Town Council:—

"*Analytical Laboratory Surgeon's Hall, Edinburgh, Dec.* 14, 1870.

"I hereby certify that on the 9th inst. I proceeded to Crieff for the purpose (1) of making a professional inspection of the district from which the proposed water supply is intended to be brought into the town, and (2) of collecting samples of water for chemical analysis. The direct source of the water is Loch Turret, a natural loch or reservoir situated in the hills lying in a northerly direction from Crieff, and the drainage district which falls into the loch is composed of uncultivated and consequently of unmanured land. Such a locality is undoubtedly the best for the collection of water for town purposes, and the shores of the loch being covered with pebbles and stones naturally tend to preserve the water in a state of purity. Samples of the water were collected by me from—1. The small stream running into the loch at the upper or northern end, and which is the principal feeder; 2. The middle of the loch, taken from the surface; 3. The middle of the loch, taken 6 feet below the surface; 4. The pier near the lower end of the loch, taken from the surface; 5. The pier near the lower end of the loch, and taken 3 feet down; and 6. The present waste weir at the southern end of the loch. These waters were examined separately, both chemically and microscopically, and were found to be entirely free from visible impurity. They were practically colourless, as only a faint shade of yellow was observable when the water was in bulk. The taste of the water was excellent, and no odour was evolved therefrom even when the water was heated. On evaporation of a mixed portion of all the samples of water, the following results were obtained, calculated to one imperial gallon:—

Chloride of sodium (common salt)	0·89 grs.
Sulphate of lime (stucco)	0·61 "
Chloride of magnesium	0·34 "
Chloride of potassium	traces.
Carbonate of lime (chalk)	0·58 "
Carbonate of magnesia	0·14 "
Carbonate of iron	0·13 "
Soluble silica	0·12 "
Organic matter	0·63 "
Total matter dissolved in an imperial gallon	3·44 grs.

Hardness, 1½°.

The above detailed analysis proves that the water from Loch Turret is of first-class quality for domestic use. It contains a minimum amount of saline matter dissolved in the imperial gallon, and the hardness is so little as to entitle the water to be regarded as soft. The organic matter is of vegetable origin, and is perfectly harmless in its nature. Special experiments were made to determine if the water had the power of acting upon lead, and it was found that the liquid was not affected in quality by being stored in cisterns lined with lead, or by being conveyed through lead pipes. In the transmission of the water to and through the town of Crieff the iron pipes (where such are used) should be coated with Smith's composition or enamel, so as to avoid the formation of any ferruginous matter. Taking all the circumstances of gathering-ground, ready-formed natural reservoir, and quality of water into consideration, I am of opinion that it is seldom any populous place has the privilege of access to such excellent water; and that, alike as a beverage for cooking purposes and in washing operations, the water from Loch Turret is of the best quality, and is second to none in the kingdom. "Stevenson M'Adam, Ph.D., F.R.S.E., F.C.S.,
"Lecturer on Chemistry."

Drainage of Oxford.—In view of the impending heavy penalty for fouling the Thames with the town sewage after May next, the local authorities, university and city, have adopted a plan for thoroughly draining the whole district of the local board, at a cost of £40,000. This will provide for some 23 miles of sewers, the contents of which, kept separate from the rainfall, will be conveyed to Iffley, rather more than a mile down the river. There it will be dealt with after the method found successful at Croydon. At the outfall the solids will be separated by a patent double screen, compressed dry by an Archimedean screw, and disposed of as manure. The liquid will be pumped up and distributed over the adjacent meadows. It will take between two and three years to complete these works, and the local board reserve power to themselves to adopt any improved methods of treating or utilizing the sewage. The scheme is prepared on a scale for the accommodation of 45,000 inhabitants, so that it will meet the needs of Oxford for a generation or two to come, even supposing the population should increase in the same rapid ratio that it has of recent years. The plans are forthwith to be forwarded to the central office in London.

Register of New Patents.

498.—John Henry Johnson, of 47, Lincoln's Inn Fields, in the co. of Middlesex, gentleman, for "*Improvements in the obtainment or production of oxygen gas.*" A communication. Provisional protection only obtained. Dated Feb. 19, 1870.

These improvements consist in effecting the solution of oxygen gas contained in the atmosphere, in water, alcohol, or other liquids which possess a greater solvent power for oxygen than for nitrogen, that being the other principal constituent. As the solubility of gases is dependent upon the pressure under which solution is effected, it is preferred to operate at high pressures, which are easily obtained by means of air and force pumps.

504.—William Edwin Heath, of No. 23, Camden Road, in the co. of Middlesex, gas engineer, for "*Improvements in gas pressure-governors.*" Provisional protection only obtained. Dated Feb. 21, 1870.

A chamber of any convenient form, but by preference circular or cylindrical, is prepared, the bottom partially open, the top entirely open, with an annular groove or trough cast or formed in the upper edge or surface; and at the bottom a conical cylindrical-shaped valve case or body is introduced, carrying in the centre, by a tripod stay, a guide for the spindle-valve. The spindle-valve is made of conical section, accurately ground to fit the opening in the valve-case, with a stem or spindle passing through the guide-hole of valve-case, and terminating in a shouldered seat, and a screw and nut for carrying the diaphragm or cup. An inverted cup or diaphragm is made of light iron, or other material indestructible in mercury, with hole in the centre to connect with the valve the edges of or rim of the cup. This is introduced into the groove or annular ring, and the groove is filled with mercury, or other suitable medium. On the bottom of the cylinder is fixed a plate of metal, which confines the valve-case in its place, and in the centre of this plate a connexion for the admission of the gas or other fluid is introduced, and at the side of the cylinder another connexion for the outlet of the same. The total weight of the valve or diaphragm is made to be equal to the desired head of water or "pressure," and any excess of pressure on the under-side of the same, by raising it, closes the valve suspended from the centre. The whole is varnished, and a cover made to protect the moving parts, which is hermetically closed at its lower edge by a washer or luting, and confined to the body of the apparatus by a flange, lugs, or other suitable method. A union joint is attached to the cover, and a pipe carried thence to any suitable position for expansion. The spindle is carried or continued through the cover, and a shelf or flange is formed thereon to receive weights to adjust the pressure within governors that are of sufficient dimensions to require that arrangement, such as street-mains or station-governors.

506.—JOHN LEOPARD, of Hassock's Station, Hurstpierpoint, in the co. of Sussex, for "*Improvements in treating and filtering sewage, and in apparatus to be employed for these purposes.*" Patent dated Feb. 21, 1870.

In carrying out these improvements the sewage is caused to flow down a channel having a slight fall or inclination. Across the channel at intervals are placed frames containing straw, or it might be rushes or heath, seaweed, or such like substances. As the sewage flows through these filters the solid matters and organic or other impurities contained in it are arrested in the straw or like material, while the clear liquid flows away from the lower end of the channel into an outlet sewer or passage. The filter frames are so constructed as to be readily lifted up from the open channels to be emptied and refilled. It is preferred to form them of network attached to two bars, one placed across the top and the other across the bottom of the channel.

510.—FRANK CLARKE HILLS, of the Chemical Works, Deptford, in the co. of Kent, manufacturing chemist, for "*Improvements in the manufacture of gas and in obtaining residual products from such manufacture, and in apparatus to be used in such manufacture.*" Patent dated Feb. 21, 1870.

This invention relates to a process described in the specification of letters patent, granted to the present inventor, No. 1369, April 25, 1868, by which process gas liquor was purified more or less perfectly from sulphur and cyanogen compounds, and from carbonic acid and other impurities, and when thus purified was used for purifying gas.

The present invention consists, firstly, in distilling the purified gas liquor obtained by the process above referred to, so as to obtain the ammonia it contains in a stronger form, and in passing it in the form of vapour into the gas to combine more or less with the carbonic acid and with the sulphur and cyanogen compounds in the gas, and thereby to render the gas more pure. The impurities taken up by the ammonia will be condensed with it in the ordinary gas liquor in the condensers and scrubbers, and if when condensed into liquid with the gas liquor it has not taken up its full dose of impurities, it may be run through a scrubber again to take up more. Instead of passing the ammonia in the form of vapour into the gas, the said ammonia may be condensed from the stills into liquid by being brought into contact with water or weak purified gas liquor in a worm or in a scrubber, or in any other convenient way, and the liquid ammonia thus obtained when of a proper strength should be introduced into the scrubbers through which the gas is passed for the purpose of purifying the gas. Eight or ten ounce liquor answers very well. The hot waste liquor running out from the bottom of the still deprived of its ammonia may be used to heat the cold gas liquor to be distilled in any convenient or well-known way so as to economize the steam used for distilling, if steam is used, and as steam can be obtained from the waste heat of gas-works, it is preferred to use steam for the purpose of distilling the gas liquor. The form of the still preferred is what is known as a column still, in which the gas liquor to be distilled runs in at the top in a continuous steam, then over the diaphragms or media contained in the still, and then out at the bottom of the still deprived of its ammonia by the current of steam admitted into the bottom of the still and passing upwards and driving off the ammonia in vapour at the top of the still, as is well understood. The ammoniacal vapour thus driven off may be condensed in any suitable condenser, but a condenser constructed as follows is preferred—viz., one that consists of a rectangular tank (with a tight cover) of any required size (say, 2 feet wide, 4 feet deep, and 8 or 9 feet long), in which tank are placed as many pipes (preferably about 3 inches in diameter) as can well be got into it. The said pipes are arranged longitudinally in successive rows, one row above another, a little space being left between each pipe. The ends of the pipes are caulked or cemented into sockets, cast on or fixed to the end plates of the tank, and a deeper socket is cast on or fixed to the said ends around every two adjoining pipe-sockets, the pipes in which are connected by means of caps or covers caulked or cemented into the outer sockets. The pipes are thus connected to one another so as to form one continuous length of pipe. The liquor to be distilled enters the lowest row of pipes, and after passing backwards and forwards from pipe to pipe through this row ascends to the next row and passes through it, and thence passes in the same way from row to row until it passes from the last pipe of the top row through another pipe into the top of the still to be distilled. Horizontal plates are fixed across the tank between each row of pipes so as to form a succession of chambers, openings being made at alternate ends of the respective plates so as to form a continuous passage through which the hot ammoniacal vapour from the still which is to be condensed passes backwards and forwards from the top of the series of chambers to the bottom. The vapour is thus caused to surround the pipes contained in the successive chambers and to heat the liquor in the pipes, the vapour being at the same time cooled and more or less condensed into liquor by the cooler surfaces of the pipes. The condensed liquor will then run out of the bottom chamber for use, and should there still be any vapour of ammonia not condensed, it may be passed into the water scrubber to be there condensed. If the gas liquor to be distilled is not sufficiently heated by passing through the pipes in the condenser which are surrounded by the hot vapour from the still, it may be passed through the pipes of another vessel of the same description as the said condenser (but which for distinction is called a heater and cooler, as it heats the gas liquor to be distilled and cools the waste gas liquor), which, deprived of its ammonia, runs away from the bottom of the still. The heater and cooler is exactly similar to the condenser, except that there is no need of the horizontal plates across the tank to separate the rows of pipe. The gas liquor to be distilled, after being somewhat heated in the condenser, must be passed through the series of pipes placed in the tank of the heater and cooler, and thence into the top of the still, whilst at the same time the waste hot liquor which runs away from the bottom of the still deprived of its ammonia is to be run into the tank of the heater and cooler. The hot liquor will thus surround all the pipes in the tank through which the gas liquor to be heated passes to the still, and which will thus become very hot. The hot waste liquor from the still should be run into the top part of the tank of the heater and cooler, and as it cools should be run out at the bottom part of the tank through a pipe bent upwards above the level of the highest pipe in the tank, so that all the pipes may be covered by the liquor. The gas liquor to be heated after leaving the condenser should enter the lowest row of pipes in the heater and cooler, and after passing through the whole series should pass out from the top row into the top part of the still. As the hot waste liquor from the still descends in the tank of the heater and cooler, the waste liquor will be cooled by imparting its heat to the pipes through which the gas liquor passes to be distilled. The heater and cooler should be placed at a lower level than the bottom of the still, so that the hot waste liquor may run from the bottom of the still into the top part of the tank of the heater and cooler.

This invention consists further in utilizing sulphuretted hydrogen which has been driven off from the gas liquor during the process of purification, described in the specification before referred to. According to this part of the invention the gases driven off from the gas liquors during purification are conducted from the last still, condenser, or purifier, or from the water scrubber by means of pipes into a furnace, where the sulphuretted hydrogen is to be burnt with a proper admixture of atmospheric air. The sulphuretted hydrogen may be passed over the fire, either through tubes made red hot or over or through the fire itself, in such a manner that by the addition of atmospheric air the sulphuretted hydrogen may be burnt or decomposed, and be converted by the process into sulphurous acid gas. This gas may be passed through pipes from the furnace into water to form liquid sulphurous acid. This liquid sulphurous acid may be used instead of water in the water condenser or purifier in communication with the still, purifier, or condenser referred to in patent. The sulphurous acid will combine with the ammonia taken up in the condenser forming sulphite of ammonia, and will prevent the escape of the ammonia, and sulphur will generally be precipitated. To make a stronger solution of sulphite of ammonia, it may be run out of the condenser when the sulphurous acid is saturated by the ammonia, and more sulphurous acid gas may be passed into the said solution so as to have acid in excess, when it may again be introduced into the condenser to take up more ammonia. This process may be repeated as long as it is found to be convenient, or the solution of sulphite of ammonia may be caused to run in and out of the condenser in a continuous stream, the solution having a supply of sulphurous acid gas passed into it in another vessel. The solution may be caused to pass from one vessel to the other by pumps or by other convenient means. Sulphur will be precipitated in the solution, which sulphur should be allowed to settle out before the solution is evaporated to form a salt. Free sulphuretted hydrogen, driven off from the gas liquor from the boilers or stills, by coming into contact with the sulphurous acid will cause a double decomposition, and the sulphur of both should be precipitated. Instead of condensing the sulphurous acid gas into water, and allowing the sulphuretted hydrogen driven off from gas liquor to pass through it, the two gases themselves may be brought together in equivalent proportions (say two volumes of sulphuretted hydrogen to one volume of sulphurous acid), and be passed through a tube or flue of any required size, or the mixed gases may be passed through a succession of chambers or vessels connected together by pipes or flues, in order that the gases may decompose one another and precipitate sulphur. When it is intended to obtain sulphur from the gases in this way the sulphuretted hydrogen burnt to form the sulphurous acid should be kept as free as possible from extraneous gases during its combustion. Therefore in this case it is preferred to effect the combustion of the sulphuretted hydrogen in tubes or chambers heated externally instead of passing it through the furnace. The mixed gases (which should contain a certain amount of moisture) may be drawn through the flues or chambers (in which sulphur is deposited as above described) by the draught of a chimney, or they may be drawn or forced through by a rotating fan or other convenient means. The sulphuretted hydrogen and sulphurous acid gas should be introduced by pipes close together into one end of the flue or chambers, so as to ensure their being perfectly mingled together during their passage through the flue or chambers. From the flue or chambers the remaining gases should be passed through an oxide of iron purifier to take up any sulphuretted hydrogen that might not be decomposed, and it would be better, in mixing the gases, to have a little excess of sulphuretted hydrogen over the sulphurous acid gas. If more convenient, instead of burning part of the sulphuretted hydrogen to form sulphurous acid, some of the sulphur obtained from the double decomposition of sulphurous acid and sulphuretted hydrogen may be burnt in any convenient apparatus, and the sulphurous acid resulting from the combustion of the sulphur may be brought into combination with the sulphuretted hydrogen set free from the purified gas liquor in such a manner that by their mutual decomposition more sulphur may be obtained; or the sulphurous acid may be obtained from the combustion of cheap pyrites or sulphur ore, and the sulphurous acid gas thus obtained may be mixed with the sulphuretted hydrogen to obtain sulphur from both. The proportions of the gases may be regulated by means of cocks, valves, or meters. The sulphuretted hydrogen, when converted into sulphurous acid gas, as described, may be used to saturate gas liquor. The sulphurous acid gas may be forced or drawn into the gas liquor by mechanical means, or it may be drawn upwards through scrubbers by the draught of a powerful chimney, while the gas liquor is caused to descend through the scrubbers to meet and come into contact with the sulphurous acid gas until it is saturated. It may then be evaporated sufficiently to form a salt if desired, or the said sulphuretted hydrogen, when converted into sulphurous acid, may be used for purifying gas. The gas after being deprived of its ammonia in any convenient way, but still retaining sulphuretted hydrogen, may be passed through purifiers containing the sulphurous acid in solution, and the gas should afterwards be passed through a purifier containing oxide of iron. The sulphurous acid will decompose the sulphuretted hydrogen in the gas, and sulphur will be precipitated. When sulphurous acid is used to saturate the ammonia which escapes from the last of the boilers, stills, or condensers used for purifying gas liquor, as described, such sulphurous acid should be run into the water condensers in a regulated quantity, so as to make a continuous process; and the saturated ammonia should at the same time be continuously run out, so as to keep the liquid in the condenser at a uniform level.

This invention consists further in using coal in the form of powder or dust for the manufacture of gas in the following manner. Retorts of the following description are constructed and used:—Each retort should have a horizontal part at bottom, with a mouthpiece as in ordinary retorts. At the top of the horizontal part of the retort one or more vertical pipes or retorts is or are fixed so as to form one retort. The vertical parts of the retorts may be of the same diameter as the horizontal part, but the horizontal part should be of greater depth than width. It is preferred to make the vertical parts of the retorts slightly conical instead of cylindrical, the largest part being at the bottom. The powdered coal is to be introduced into the retort at the top of the vertical parts thereof in such a manner that it falls down through the vertical parts in a continuous gentle stream. This may be effected either by means of a revolving archimedian screw or creeper working in a tight wrought-iron case furnished with a hopper with double valves to prevent the escape of gas, one being shut when the other is open for introducing the coal, the screw or creeper being worked by suitable machinery; or the coal may be introduced into the top of the retorts in any other convenient way, care being taken that means are provided for cleansing the vertical parts of the retorts in case they become incrusted with carbon. The powdered coal, in falling through the vertical parts of the retorts, becomes more or less decomposed, and the gas and tar vapour formed may be taken into a hydraulic main and condensers in the same manner as the gas from ordinary gas-retorts. If any coal was not decomposed whilst falling through the vertical parts of the retorts, it would be completely carbonized in the horizontal part, and the quantity of coal admitted into the retort must be regulated to effect this object. Rich gas may be obtained from the tar condensed by running it in a continuous stream through several stills, so that the whole of the gas that the powdered coal will make may be obtained. To effect this the tar is run through a series of stills, say 3, 4, or 5. Each succeeding still should be placed at a higher level than the preceding one, and the stills should be connected by pipes in such a manner that the tar will run into the top still, thence down through the series of stills, and then out of the bottom still.

The vapour arising from the distillation of the tar in the first still may be condensed by itself by means of a worm or otherwise, as the oil or spirit obtained is of more value than gas obtained from it would be. The vapour from the other stills is to be conducted by suitable pipes into one or more of the vertical parts of the retorts already described for decomposing the powdered coal, but in this case the retort should be filled with pieces of coke. By coming into contact with the red-hot surfaces, the vapour from the tar will be decomposed into gas, or a separate retort of the same description may be filled with pieces of coke, and the tar vapour may be caused to pass up or down through the said retort and between the pieces of coke therein contained, which being kept red hot will decompose the tar vapour into gas. The tar being deprived of its more volatile parts by running through the stills, will be converted into pitch in the lowest still, whence it may be run out in a continuous stream into a vessel, which should keep it liquid until it was full, when it might be run into a mass to cool. Instead of running the tar through several stills, one still only may be used after the light spirit is distilled off from the tar, but in this case

the still should be longer than broad, and the still should be divided by partitions fixed transversely across its length, so as to divide the still into three or four or more parts. There should be small openings made in the bottom of the partitions for the tar to pass from one compartment to another until it reaches the compartment where it is to be made into pitch. Openings must also be made in the upper part of the partitions for the vapour from each compartment to escape to the decomposer. The still might be three or four times as long as it is broad. The fire for heating the still should be placed at the end where the pitch is to be formed, at which end the heat should be greatest, and the flues should be taken from the fireplace to heat the other parts of the still.

The series of tar stills above described may be heated by one fire or by several fires. If one fire only is used, it should be placed under the bottom still, and flues from it might be taken to work the other stills, or a separate fire may be used to each still, or the light spirit may be distilled off from the top still by steam heat. Of course, ordinary coal tar formed in the usual way may be converted into rich gas by being treated as described.

556.—William Bradshaw Leachman, of Leeds, in the co. of York, for "*Improvements in hydraulic apparatus for raising and forcing water.*" Patent dated Feb. 25, 1870.

On a suitable foundation-plate is fixed a double-acting pump of ordinary construction and two hydraulic cylinders of ordinary construction. These are placed in such a position with respect to each other that the rod which carries the bucket in the pump is arranged so as to act as plunger or ram in each of the aforesaid hydraulic cylinders. A single-acting pump may be used when required. In places where there is not sufficient room for the hydraulic cylinders, a different arrangement of the interior of the pump is adopted, by having a fixed rod and piston on which a hollow cylinder or bucket is mounted.

577.—John Randall Mann, of East Cowes, in the Isle of Wight, for "*Improvements in and connected with water-closets and other sanitary appliances.*" Patent dated Feb. 26, 1870.

In carrying out this invention, the bottom or lower part of the pan or basin has a syphon-pipe connected to it, the long leg of which connects with the soil-pipe, or with a trap which leads to the drain or sewer. The action of the closet is as follows:—Before the handle is pulled the basin contains its normal quantity of water (say one-third of a gallon), which, while serving for the proper reception of foul matters, at the same time seals the communication between the basin and the syphon-pipe which leads to the drain. When the handle is pulled a quantity of water (say half a gallon) is quickly discharged into the basin, and the impulse and effect thus produced cause the water to flow up the short leg of the syphon, and over its top bend, falling down its longer leg, and driving forward the air, or a portion of the air, contained therein; and in passing through or out of the bottom of the longer leg the water is checked in its flow, and the syphon is brought into or continued in action, drawing the contents of the basin forward so as to pass on into the soil-pipe, trap, or drain, without allowing foul air to escape backwards into the basin or apartment.

APPLICATIONS FOR LETTERS PATENT.

88.—Robert Mills, of Greenock, in the co. of Renfrew, N.B., ship smith, for "*Improvements in ship and other pumps.*" Jan. 13, 1871.

90.—Samuel Brothers Darwin, of Shrewsbury, in the co. of Shropshire, for "*Improvements in apparatus used in the manufacture of gas.*" Jan. 13, 1871.

113.—John Fleming Allan, of Glasgow, in the co. of Lanark, N.B., for "*Improvements in making illuminating gas, and in apparatus therefor.*" Jan. 16, 1871.

143.—Peter Brotherhood and George Dominicus Kittoe, both of 56, Compton Street, Clerkenwell, in the co. of Middlesex, engineers, for "*Improvements in apparatus for regulating and measuring the flow of fluids.*" Jan. 20, 1871.

151.—James Hosken, of 58, Fenchurch Street, in the City of London, engineer, for "*Improvements in automatic apparatus for controlling the flow of liquids from constant supply pipes or vessels.*" Jan. 20, 1871.

164.—Alexander Kirk Rider, of the city of New York, in the state of New York, U.S.A., for "*Improvements in air and gas engines.*" (Complete specification.) Jan. 21, 1871.

166.—Charles Hunt, of Nine Elms, in the co. of Surrey, for "*Improvements in apparatus used in the manufacture and distribution of gas.*" Jan. 23, 1871.

174.—John Paterson Waterson, of Forest Hill, in the co. of Kent, builder, for "*Improvements in or applicable to hot water apparatus, also applicable to water-pipes.*" Jan. 23, 1871.

182.—Alfred Smee, of 7, Finsbury Circus, in the City of London, Fellow of the Royal Society and Fellow of the Royal College of Surgeons of England, for "*Improvements in supplying towns and villages with water adapted for drinking purposes.*" Jan. 24, 1871.

184.—William Edward Newton, of 66, Chancery Lane, in the co. of Middlesex, civil engineer, for "*Improvements in meters for measuring liquids.*" A communication. Jan. 24, 1871.

185.—Charles Ritchie, of Brixton, in the co. of Surrey, gentleman, for "*Improvements in apparatus for utilizing heat for heating, warming, ventilating, cooking, lighting, and sanitary purposes.*" Jan. 24, 1871.

200.—Charles Edmund Webber, of Cornwall Gardens, Kensington, in the co. of Middlesex, captain in the Royal Engineers, for "*Improved means of forcing air or gas through tubes.*" Jan. 25, 1871.

201.—Robert Porter and Thomas Lane, both of 172, Fenchurch Street, in the City of London, engineers, for "*Improvements in the manufacture of gas for illumination, and in the apparatus connected therewith.*" Jan. 25, 1871.

GRANTS OF PROVISIONAL PROTECTION.

35.—John Lupton Bolding and John Thomas Bolding, both of 19, South Molton Street, Oxford Street, and Joseph Titsink, of 28A, York Street, Baker Street, both in the co. of Middlesex, for "*Improvements in water-closets, and in valves and regulating apparatus for the same, and for other purposes.*" Jan. 6, 1871.

53.—Thomas Goode Messenger, of Loughborough, in the co. of Leicester, hydraulic engineer, valve manufacturer, and horticultural builder, for "*Improvements in the coupling of pipes.*" Jan. 10, 1871.

88.—Robert Mills, of Greenock, in the co. of Renfrew, N.B., ship smith, for "*Improvements in ship and other pumps.*" Jan. 13, 1871.

90.—Samuel Brothers Darwin, of Shrewsbury, in the co. of Shropshire, for "*Improvements in apparatus used in the manufacture of gas.*" Jan. 13, 1871.

113.—John Fleming Allan, of Glasgow, in the co. of Lanark, N.B., for "*Improvements in making illuminating gas, and in apparatus therefor.*" Jan. 16, 1871.

INVENTION PROTECTED FOR SIX MONTHS ON THE DEPOSIT OF A COMPLETE SPECIFICATION.

164.—Alexander Kirk Rider, of the city of New York, in the state of New York, U.S.A., for "*Improvements in air and gas engines.*" Jan. 21, 1871.

NOTICES TO PROCEED.

2434.—Treat Timothy Prosser, of Chicago, Illinois, U.S.A., engineer, at present residing at 198, St. Vincent Street, Glasgow, in the co. of Lanark, N.B., for "*A new or improved tube-expander and tube-cutter combined.*" Sept. 8, 1870.

2516.—Gustav Bischof, jun., of Bonn, in the kingdom of Prussia, but at present residing at the Craven Hotel, Craven Street, Strand, in the co. of Middlesex, for "*Improvements in the means employed for the purification of water.*" Sept. 19, 1870.

2521.—Alexander Horace Brandon, of 13, Rue Gaillon, Paris, in the empire of France, engineer, for "*Improvements in vapour or gas burners.*" A communication. Sept. 19, 1870.

3080.—William Prangley, of Salisbury, in the co. of Wilts, for "*Improvements in commodes or portable water-closets.*" Nov. 24, 1870.

3162.—John Joseph Parkes, of 17, London Street, Paddington, in the co. of Middlesex, gas engineer, for "*Improvements in gas-stoves or apparatus for cooking and heating purposes.*" Dec. 2, 1870.

3323.—John Reid, of Leith, in the co. of Mid Lothian, N.B., engineer and manager of the Edinburgh and Leith Gaslight Company, for "*An improved liquid-meter.*" Dec. 20, 1870.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

138.—Joshua Kidd, "*Improvements in obtaining artificial light, and in apparatus employed therein.*" Jan. 15, 1868.

146.—Clinton Edgcumbe Brooman, "*Improvements in gas heating and cooking apparatus.*" Jan. 16, 1868.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

156.—James Wilson, "*Improvements in hydraulic valves for working gas-purifiers.*" Jan. 21, 1864.

Share List of Metropolitan Gas Companies.

Number of Shares issued.	Amount per Share.	Name of Company.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Latest Quotations.
	£		£ s. d.	£ s. d.	£
8000	10	Anglo-Romano	10 0 0	10 0 0	11 — 12
5000	20	Bahia (Limited)	20 0 0	3 0 0	13 — 14
1000	20	Do., preference	20 0 0	10 0 0	25 — 26
750	20	Do., do., redeemable	20 0 0	10 0 0	20 — 22
40000	5	Bombay (Limited)	5 0 0	4 10 0	6¼ — 7
10000	5	Do., third issue	4 0 0	4 10 0	5⅛ — 5⅜
10000	20	British (Limited) (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton [Potteries], Trowbdge., & Holywll.)	20 0 0	10 0 0	30⅝ — 31¼
7500	20	Cagliari (Limited)	20 0 0	7 0 0	
112000	10	*Chartered*	10 0 0	9 0 0	15⅛ — 15⅜
10000	10	Do., B shares, 4 per cent. max.	10 0 0	4 0 0	6¾ — 7¼
25000	10	Do., 5 per cent. preference	10 0 0	5 0 0	12⅛ — 13
20000	10	Do., 10 per cent. preference	10 0 0	10 0 0	19½ — 20
17490	25	*Commercial*	25 0 0	10 0 0	42 — 43
20000	20	Continental Union	20 0 0	8 0 0	23½ — 24¼
10000	20	Do., new	7 10 0	8 0 0	9 — 9¼
5213	20	Do., preference (France: Strasbg., Cette, Nismes, Montargis, Vienne, Roanne, Beaucaire, Rueil, Albi. Italy: Milan, Genoa, Parma, Modena, Alessandria, Messina.)	20 0 0	7 0 0	24 — 26
5000	10	*Crystal Palace District*	10 0 0	10 0 0	16 — 17
5000	10	Do., preference	10 0 0	6 0 0	11 — 12
6044	10	Do., new shares	10 0 0	7 0 0	11 — 12
3956	10	Do.	1 0 0	7 0 0	.. — 1¼
4000	50	*Equitable*	50 0 0	10 0 0	88 — 90
4000	25	Do., new shares	25 0 0	10 0 0	43 — 45
23406	10	European (Limited)	10 0 0	11 0 0	14½ — 15¼
12000	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	5 0 0	11 0 0	7¼ — 8
5000	10	Hong Kong (Limited)	10 0 0	9 0 0	11 — 12
26000	50	*Imperial*	50 0 0	10 0 0	84 — 86
26000	10	Do., new shares	10 0 0	10 0 0	16½ — 16⅞
26000	12½	Do., new shares	12 10 0	7 0 0	15 — 16
25000	12½	Do., new shares, 1870	2 10 0	7 0 0	3⅞ — 4¼
1300	100	Do., bonds	£100	10 0 0	165 —170
56000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam, Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Cologne, Frankfort-on-Maine, Haarlem, Stolberg, Toulouse, & Vienna.)	43 15 0	9 2 6	64 — 65
400	100	Imperial Mexican (Limited)	100 0 0	nil.	
200	100	Do., new	100 0 0	nil.	
3000	40	*Independent*	40 0 0	10 0 0	67½ — 68½
3000	10	Do.	10 0 0	5 0 0	7½ — 8¼
3000	20	Do.	17 0 0	7 10 0	3 — 4 pm.
7133	50	*London*	50 0 0	10 0 0	83½ — 84¼
5610	25	Do., 1st preference	25 0 0	6 0 0	28¼ — 29½
503	50	Do., 2nd preference	50 0 0	6 0 0	
214	50	Do., 3rd preference	50 0 0	6 0 0	
£18781		Do., 1st preference stock		6 0 0	
£11828		Do., 2nd preference stock		5 0 0	
		Nictheroy, Brazil (Limited)			
15000	5	Malta and Mediterranean (Limited)	5 0 0	4 10 0	3⅞ — 4¼
6000	5	Do., preference	5 0 0	7 0 0	4⅞ — 5¼
20000	5	Mauritius (Limited)	2 0 0		2 — 2¼
30000	5	Oriental (Calcutta)	5 0 0	10 0 0	7⅜ — 8¼
30000	5	Do., new shares	2 10 0	10 0 0	3½ — 4
10000	5	Ottoman (Limited)	5 0 0	nil.	2 — 2¼
14000	10	Pará (Limited)	10 0 0	10 0 0	10 — 11
27000	20	*Phœnix*	20 0 0	10 0 0	34 — 35
3800	100	Do., new	40 0 0	7 10 0	53 — 55
144000	8k.	Do.	100 0 0	5 0 0	88 — 90
5000	20	*Ratcliff*	20 0 0	10 0 0	31½ — 32¼
	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	28¼ — 29¼
6959	5	Singapore (Limited)	5 0 0	7 0 0	
2000	5	Do., preference	5 0 0	7 10 0	
1500	32½	Shanghai	32 10 0	12 0 0	
4000	50	*South Metropolitan*	50 0 0	10 0 0	87 — 89
4000	12½	Do.	12 10 0	10 0 0	21½ — 22½
20000	12½	Do., new shares	2 10 0	10 0 0	5 — 5⅛
15000	10	*Surrey Consumers*	10 0 0	10 0 0	15½ — 16¼
10000	10	Do., new	6 0 0	10 0 0	10 — 11
9000	4	United General (Limerick)	4 0 0	5 0 0	2⅜ — 2⅝
1500	10	*Wandsworth and Putney*	10 0 0	10 0 0	10 — 12
1500	10	Do.	10 0 0	7 10 0	
1819	10	Do.	10 0 0	7 10 0	
1138	10	Do.	5 0 0	7 10 0	
20000	10	Western (Limited) A shares	10 0 0	10 0 0	17 — 18
10000	10	Do., B shares	9 0 0	10 0 0	15½ — 16
10000	10	Do., C shares	9 0 0	10 0 0	15½ — 16
20000	10	Do., D shares	1 0 0	10 0 0	3½ — 4
16000	5	*West Ham*	5 0 0	8 0 0	7 — 7¼
10000	5	Do., new shares	1 0 0	8 0 0	
551	10	West London Junction (Limited)	10 0 0	6 0 0	
520	10	Do., preference	10 0 0	6 0 0	

Price Current.

CASTINGS.—*Per Ton.*

Average Weight of Cast-iron Gas-pipes, per Yard.

1 in.	2 in.	2½ in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lb.

Retail Prices are 5 to 10 per cent. higher.	London.	Glasgow.	Newcastle and Middlesboro'.	Wales.	Yorkshire, Derbyshire, and Staffordshire.
	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Pig Iron, No. 1 (g.m.b.)	3 15 0	2 12 6	2 9 0	3 10 0	3 15 0
1¼ and 2-inch Socket-pipes	7 0 0	5 15 0	5 10 0	6 0 0	7 0 0
2½ and 3-inch ditto	6 10 0	5 5 0	5 0 0	5 18 0	6 10 0
4 and 5-inch ditto	6 0 0	4 15 0	4 10 0	5 5 0	6 0 0
6 inches and upwards ditto	5 15 0	4 5 0	4 0 0	5 0 0	5 15 0
Retorts, 1st fusion, hot blast	5 10 0	4 10 0	4 5 0	5 0 0	5 10 0
Ditto, 2nd ditto, cold ditto	6 10 0	—	—	—	6 10 0
Tank-plates, ¼ thick and above	6 0 0	5 0 0	4 15 0	5 10 0	6 0 0

WROUGHT-IRON TUBING,

Subject to 60 per cent. Discount.

	2 in.	1¼ in.	1½ in.	1 in.	¾ in.	½ in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent Welded Tubes, from 2 to 14 feet—per foot	1 8	1 1	0 10	0 7	0 5	0 4½
Ditto ditto, from 12 in. to 23½ in.—each	3 0	2 0	1 6	1 1	0 9	0 8
Long Screws, from 12 in. upwards	4 0	2 3	2 0	1 6	1 2	0 11
Bends and Springs	4 2	2 3	1 9	1 3	0 11	0 8
Square Elbows, equal or reducing; Round Elbows, 5 per cent. extra	3 9	2 3	1 9	1 3	0 10	0 8
Tees, wrought or cast	4 0	2 6	2 0	1 6	1 1	0 9
Crosses, ditto, equal or reducing	4 9	3 6	3 0	2 3	1 9	1 6
Iron Cocks	20 9	13 0	10 0	7 3	5 0	3 8
Ditto, with brass plug	28 0	16 0	13 0	7 0	5 6	4 6
Diminishing Sockets, Caps, Plugs, and Nipples	1 3	0 9	0 8	0 6	0 5	0 4½
Plain Sockets	1 0	0 8	0 7	0 5	0 4	0 3
Syphons, 2-quart	16 0	14 0	13 6	13 0	12 0	—

FREIGHTS.

Coastwise—Newcastle:—	Per Ton.	*Foreign:—*	Per Keel.
Chatham and Rochester	6s. 6d	Barcelona	£18 0s
Cork	—	Bordeaux	12 0
Dover, Folkestone, and Ramsgate	7 3	Boulogne and Calais	8 10
Dublin	8 9	Cadiz	10 0
Exeter Quay	10 0	Cronstadt	—
Ipswich	6 6	Copenhagen	—
London (from Leith)	8 6	Genoa	17 10
London (Pool)	6 6	Hamburg	—
Lowestoft and Yarmouth	5 6	Havre de Grace	10 0
Portsmouth & Southampton	7 6	Leghorn	17 5
Plymouth	8 6	Lisbon	9 10
Shoreham	7 6	Rotterdam	—
Whitstable	7 0	Stettin	—
Weymouth	8 0	Trieste	18 10
		Venice	20 0

GAS COALS.

Newcastle—Unscreened:—	Per Ton.
	6s. 6d.
Haswells, Nettlesworth Primrose, and South Pelaw	
Felling, Framwell Gate, North Pelton, Redheugh Main, Walker's Primrose, West Wear, and Whitwell Primrose	6 9
Burnhope, Craghead, Charlaw, Derwent, East Castle, Edmondsley, Eighton Moor, Hartlepool Pelaw, Holmside, Lambton's Gas, Lanchester Pelaw, Medomsley, Mickley, New Pelaw, Pelaw Main, Ravensworth, Seaham, South Moor Pelton, South Leverson, Townley Main, Tyne Main, West Pelaw, Wearmouth Hutton, and Witton	7 0
Peareth, Ravensworth Pelaw, Waldridge, West Garesfield, and West Pelton	7 3
Brancepeth, Dean's Primrose, Londonderry Gas, New Pelton, Pelton, South Peareth, Stella, Urpeth, Washington Hutton, and West Leverson	7 6
Ramsay's Newcastle Cannel	17 6
Wigan Cannel (at Liverpool)	17 0
Welsh Cannel:—	
Coppa Cannel (on rails at Birkenhead), 13s. 6d.; ditto (on rails at Connah's Quay)	13 0

Scotch Cannel, f.o.b.:—	Per Ton.	*Scotch Cannel*, f.o.b.:—	Per Ton
Boghead—at Bo'ness, 47s. 6d.; at Leith	48s. 2d	Arniston (at Leith)	21s. 0d
Muirkirk	27 0	Wemyss (at Wemyss)	20 0
Kirkness, best (at Burntisland)	22 6	Haywood Co.'s Haywood (at Granton)	20 0
Capeldrae, 1st quality (at ditto)	22 6	Pirnie, or Methill	17 0
Ditto, 2nd ditto (at ditto)	17 6	Lothian's Cannel (at Leith)	24 6
Cowdenbeath (at ditto)	12 0	Grange ditto (at Bridgeness)	17 6
Lochgelly (at ditto)	12 0	Kinniel ditto (at Bo'ness)	17 6
Donnibristle—at Burntisland, 12s.; at Aberdour	12 6	Myles' ditto	23 6
Auchinheath Lesmahago (at Granton)	27 0	Lochore Parrot (at Burntisland)	22 6
Duke of Hamilton's Lesmahago (at Granton)	27 0	Lanemark (at Glasgow)	16 0
		Elphinstone Tower (at Leith)	20 0

SUNDRIES.

Best Newcastle Fire-bricks, per 1000	£2 10s. to £2 15s. 0d.
Cliff's Fire-bricks (at Wortley), per 1000	2 15 0
Ingham's ditto (at Wortley), per 1000	2 15 0
Farnley Iron Co.'s Fire-bricks (at Wortley), less discount	2 17 0
Fire-clay Retorts, per foot run	5s. 6d. to 0 7 6
Tarred Rope Yarn, per cwt.	1 0 0

THE

DUKE OF HAMILTON'S

LESMAHAGOW

CANNEL COAL.

LESSEES:

THE NITSHILL & LESMAHAGOW COAL COMPANY.

OFFICE:

37, ST. VINCENT PLACE,

GLASGOW,

Where all communications are requested to be addressed.

FLETCHER, SPECK, & CO.,

CONTRACTING GAS ENGINEERS, IRON & BRASS FOUNDERS,

GLENGALL IRON-WORKS, **MILLWALL, LONDON, E.,** and RATCLIFF FOUNDRY, **COMMERCIAL ROAD EAST, LONDON, E.,**

MANUFACTURERS OF

TELESCOPIC and **SINGLE GASHOLDERS, TANKS, PURIFIERS, CONDENSERS,** and every description of **GAS-MAKING APPARATUS. IRON MAIN-PIPES** supplied and laid. **RETORTS, MOUTHPIECES, CROSS-BARS, RETORT-LIDS, VALVES, WROUGHT-IRON TUBES,** and **FITTINGS.** Wrought and Cast Iron Hydraulic Mains. **LAMP-POSTS, COLUMNS, GIRDERS, BRIDGES,** &c.

CORRUGATED IRON ROOFS & BUILDINGS.

Coke Barrows, Shovels, Scoops, Bolts & Nuts, Cotters, &c., kept in Stock.

"METER LIFE BOOK,"

By R. P. KEYS, Accountant, 26, BUDGE ROW, LONDON, E.C.

2nd Edition. Specimen Sheets, Illustrated, 3s. 6d.; will be 5s. shortly.

Has been adopted in England, Scotland, and Ireland. Simplest plan that has been projected.

GEORGE SKEY AND CO.,

LIMITED,

WILNECOTE WORKS, NEAR TAMWORTH,

MANUFACTURERS OF

Fire-Clay Retorts, Fire-Bricks, Furnace Bricks, Lumps, Burrs, Tiles, Quarries, Grate Backs, Crucibles and Chemical Apparatus;

Glazed Stoneware Sewerage Pipes, Invert Blocks, Traps, Syphons, &c.

SOLE AGENT FOR FIRE-CLAY RETORTS AND GAS COMPANIES FIRE GOODS.

THOMAS PROUD, Gas Engineer,

7, UNETT STREET, ST. GEORGE'S, BIRMINGHAM.

WANTED, by a young Man, a situation to repair, prove, or fix gas-meters; town or country. Address G. L., 65, Allscot Road, Grange Road, BERMONDSEY.

FOREMAN OF GAS-WORKS.

WANTED, by the Colchester Gas Company, an energetic Man as WORKING FOREMAN. Wages 24s. per week, with cottage, fuel, and gas.

Applications, by letter only, stating age and qualifications, and enclosing copies of testimonials, to be addressed to the MANAGER, Gas-Works, COLCHESTER.

Gas-Works, Colchester, Jan. 27, 1871.

MANAGER OF GAS-WORKS.

WANTED, a steady, respectable, married Man, who thoroughly understands the manufacture and distribution of coal gas, laying of service-pipes, fixing and repairing meters, &c. As the works are small, he will have to perform all the duties required with the assistance of a lad, or a man in the winter months. There is a comfortable dwelling-house on the premises.

Applications, stating age and qualifications, with testimonials as to character and fitness, to be sent before the 11th of February next, to Mr. W. H. DAUBNEY, Solicitor, GREAT GRIMSBY.

WANTED, at or before Lady-day next, an engagement as Manager, or Secretary and Manager of a Gas-Work, where the annual production is about 50 million cubic feet. The Advertiser is at present engaged as Assistant Manager to a Gas Company in a large provincial town.

Address J. H. A., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, a re-engagement on a Gas-Work. Understands manufacture, testing, main and service laying, fitting, &c.; also book-keeping and collecting. Excellent testimonials.

Address H. N. H., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED to Purchase, a second-hand DRY LIME PURIFIER, about 10 ft. square, without valves or connexions.

Address MANAGER, Gas-Works, Camborne, CORNWALL.

STATION-METER.

WANTED, a Station-Meter, second hand, in good order, to pass 6000 cubic feet per hour.

Apply to J. GEMLOW, Gas-Works, Cupar, FIFE, N.B.

WANTED to Purchase, next summer, a set of good second-hand DRY LIME PURIFIERS, three or four in number, about 8 ft. square.

Apply to A. THOMAS, Gas-Works, Alton, HANTS.

A Gas Engineer has a Son who wants IMPROVEMENT in a large Gas-Work. Aged 21.

Apply to Mr. MALAM, Gas-Works, Northallerton, YORKS.

CLERK WANTED.

THE Bombay Gas Company, Limited, require the services of a JUNIOR CLERK in the London office. Must write neatly and expeditiously, and be good at figures. Salary progressive, commencing at £60.

Apply by letter only, addressed to the SECRETARY, 4, Great Winchester Street Buildings, LONDON.

THE Directors of the Gravesend and Milton Gaslight Company are about to appoint a SUPERINTENDENT of their works at Gravesend. He will be required to have a thorough practical knowledge of gas machinery and works, and the manufacture of gas; and also to have had experience in the actual working of Gas-Works.

Particulars of the duties of the office can be seen at my Office, 4, Edwin Street, Gravesend. The salary will be £200 per year, with house at the works, coals, and gas.

Letters from candidates, enclosing testimonials as to character and ability (which will be returned on application), are to be sent to me, endorsed "Superintendent, Gas Company," on or before the 14th day of February, 1871, after which date an appointment will be made with candidates whose attendance is required.

F. G. SOUTHGATE, Secretary,

Gravesend, Jan. 26, 1871.

FOR SALE, Sixteen 10-in. Rack and PINION VALVES, in good working order, equal to new. These valves are being disposed of simply to make room for larger, and will be sold on reasonable terms.

Apply to the Manager of the Gas-Works, Keyham, DEVONPORT. JOHN WILLING, Secretary.

STATION-METER.

FOR SALE, a Station-Meter to pass 15,000 cubic ft. per hour, in a handsome square case; made in 1854.

For particulars, apply to JOHN EUNSON, Gas-Works, NORTHAMPTON.

FOR SALE, a Combined Purifier and CONDENSER, with centre change-valve, suitable for 300 lights. Extreme size, 7 ft. 5 in. by 6 ft. by 3 ft. 1 in. high.

Apply to the BRYMBO COMPANY, near WREXHAM.

CONTRACT FOR TAR.

THE Directors of the Phœnix Gas Com-pany are prepared to receive TENDERS for the TAR made at their works, either in respect to all or any of their stations. (The quantity is about 11,000 butts per annum—viz., Vauxhall, 6000; Bankside, 2500; and Greenwich, 2500.) It must be removed by barges, as directed by the Company's officers. Cash monthly.

The contract to be for a period not exceeding five years. Tenders stating the stations or station, the term, and accompanied by the names of two responsible bondsmen, to be sent in on or before the 1st of February ensuing, at Twelve o'clock.

The Directors do not bind themselves to accept the lowest or any tender.

I. A. CROCKENDEN, Secretary.

70, Bankside, S.E., Jan. 6, 1871.

LAW UNION
FIRE & LIFE INSURANCE COMPANY.

CHIEF OFFICE:

126, CHANCERY LANE, LONDON, W.C.

Capital—ONE MILLION STERLING,

Fully subscribed by upwards of 450 Shareholders, nearly all of whom are members of the Legal Profession.

CHAIRMAN—Sir WILLIAM FOSTER, Bart., Norwich.
DEPUTY-CHAIRMAN—JAMES CUDDON, Esq., Barrister-at-Law, Goldsmith Building, Temple.

The Capital subscribed and Funds in hand amount to upwards of £1,250,000, affording unquestionable security. The Directors invite particular attention to the new form of Life Policy, which is free from all conditions.

The Company advances money on Mortgage of Life Interests and Reversions, whether absolute or contingent.

Gas-Works insured against Fire and Explosion, and Coals against Spontaneous Combustion.

Rates of Premium from 2s. to 10s. 6d.

Prospectuses, copies of the Directors' Report and Annual Balance-Sheet, and every information sent post free on application to

FRANK M'GEDY, Actuary and Secretary.

TAR.

TENDERS will be received by the Llandudno Water and Gas Company, North Wales, for all the TAR produced at their Gas-Works.

Tenders to be addressed to the MANAGER, Gas-Works, Llandudno, NORTH WALES.

ST. MARY CHURCH LOCAL BOARD, DEVON.

TENDERS are invited for the supply of about 700 Tons of GAS COAL, to be delivered free of all charges into trucks at the Kingswear Station, Dartmouth, or free of all charges into carts at the Torquay Harbour. About 200 tons to be delivered the second week in April, 250 in July, and 250 in September or October.

State quantity and quality of gas and coke produced, and price of the Coal per ton. The lowest or any tender will not necessarily be accepted. Tenders to be delivered on or before the 1st of March, 1871.

Address CLERK of the Gas-Works, St. Mary Church, DEVON, endorsed "Tender for Gas Coals."

TAR.

THE Directors of the Cambridge Uni-versity and Town Gaslight Company are open to receive OFFERS for their produce of TAR, particulars of which may be had from W. WOOD, Manager.

TO GAS COMPANIES AND OTHERS.

THE Directors of the Warrington Gas Company have the following materials for sale—viz., 43 ft. D-shaped Hydraulic Main, 17 in. by 17¼ in., for settings of 5 Retorts, in sections of 7 1-12th ft., complete with dip-pipes and connexions, in good condition; 114 ft. Circular Hydraulic Main, 14 in. diameter, in sections of 5 to 12 ft., for settings of 3 retorts; 37 Circular Mouthpieces, 14 in. diameter; 14 D-Mouthpieces, 15 in. by 13¼ in., and 21 do., 19½ in. by 12½ in.; 100 Ascension-pipes, Retort-lids, and Cross-bars; various flanged 10-in. pipes, bends, and other connexions.

Further particulars may be learned on application to the undersigned, who will receive offers at a rate per ton, in whole or in part, delivered at the railway station, Warrington. JAMES PATERSON, Engineer.

Gas Company's Offices, Mersey Street,
Warrington, Jan. 25, 1871.

TO GASHOLDER MAKERS.

THE Committee of Darlington Corpora-tion Gas-Works are prepared to receive TENDERS for a TELESCOPIC GASHOLDER, the inner lift 68 ft. diameter and 20½ ft. deep, the outer lift 70 ft. diameter and 20 ft. deep, with columns, girders, and other appendages.

Further information may be obtained on application (personally or by letter) to G. Emmott, of Wood Bank, Disley, near Stockport, where plans and specifications may be seen.

Tenders to be sent in on or before the 21st day of February, 1871, addressed J. W. Armitage, Borough Accountant, Town-Hall, Darlington, endorsed "Tender for Gasholder."

The Committee do not bind themselves to accept the lowest or any tender. GEO. EMMOTT, Engineer.

SHARES IN THE LONDON GASLIGHT COMPANY.

MESSRS. VIGERS are instructed to offer for SALE by AUCTION, at the London Tavern, Bishopsgate Street, on WEDNESDAY, Feb. 8, 1871, at Twelve for One o'clock, the following SHARES in the LONDON GASLIGHT COMPANY—viz., 162 ordinary shares of £50 each, for some years past paying a dividend half yearly, at the rate of 10 per cent. per annum, and 350 first preference shares of £25 each, bearing a fixed dividend payable half yearly of 6 per cent. per annum. A half year's dividend will be due and payable in April next upon the preference shares. The shares will be sold in convenient lots, free of stamp duty and transfer fees, and they are issued to meet the cost of extending the company's works, and with a view to converting the share capital into stock.

Particulars and conditions of sale may be had at the place of sale, at the Estate Exchange, Tokenhouse Yard, LOTHBURY; at the Offices of the London Gaslight Company, 26, Southampton Street, STRAND; and of MESSRS. VIGERS, 4, Frederick's Place, OLD JEWRY, E.C.

CAST-IRON Retorts, Socket-Pipes, with Syphons, and all requisite Connexions, Lamp Columns, Wrought-Iron Tubing, Valves, Street-Lamps, Sight Holes, Furnace Doors, Ash-Pans, Charging and Coke Shovels, Iron Pails, Coke Barrows, Cross Bars, Fire Pots, Pumps, and Iron Borings.

PURIFIERS, CONDENSERS, & SCRUBBERS erected complete, or the materials supplied; and every description of goods in use by Gas-Works, in stock, at wholesale prices, at

Mr. LYNCH WHITE'S,

Old Barge Iron Wharf, Upper Ground Street, LONDON.

GAS Lighting, St. John's, Porto Rico. On the 20th of March, 1871, will be offered at PUBLIC AUCTION, in the Town-Hall, St. John's, Porto Rico, the CONTRACT for Lighting the City with GAS for Six years, from the 13th of April, 1871, in conformity with the printed conditions, a copy of which may be obtained on application to Messrs. DARTHEZ BROTHERS, 15, Austin Friars, LONDON.

ALFRED LASS,
ACCOUNTANT.

28, NORTH STREET, WANDSWORTH, S.W.

Mr. Alfred Lass having had considerable experience in arranging, making up, balancing and auditing gas accounts, begs to inform the Directors of Gas Companies that he may be consulted on all matters relating thereto.

Balance-sheets prepared, Accounts audited, Consultations, Agencies, &c.

BOOKS FOR GAS ACCOUNTS.

ALFRED DOUBBLE & Co., 2, Serjeants INN, and 40, FLEET STREET, LONDON, make and supply all the various ACCOUNT-BOOKS as approved and adopted by Accountants, &c., to Gas Companies.

A complete set of the Books and Forms forwarded within a few days from receipt of order.

EDWD. SANDELL, Public Accountant and Auditor, 4, Skinner's Place, Size Lane, LONDON.

The projector of the *Gas Companies Analyzed Expenditure Account-Book* offers his experience and services in the examination, preparation, and production of all accounts in reference to Gas Companies. References if required.

CONSULTING GAS ENGINEERS.

MESSRS. GEORGE HEDLEY & CO., 5, GEORGE STREET, WOLVERHAMPTON,

Advise upon PARLIAMENTARY ARBITRATIONS, and all matters connected with Gas.

Plans and Specifications prepared for the Erection and Alteration of Works.

ALFRED PENNY, Gas and Consulting ENGINEER,

WENLOCK IRON-WORKS,

21, WHARF ROAD, CITY ROAD, LONDON.

Mr. PENNY having had a large experience in the construction, alteration, and management of Gas-Works, begs to inform the Directors of Gas Companies that he may be consulted on all matters appertaining thereto. He also manufactures Gasholders, Purifiers, and all the various apparatus used in Gas-Works, and keeps in stock Retorts and Mouthpieces, Socket-Pipes, Bends, Branches, and T-pieces, &c., &c.

Plans, Specifications, and Estimates prepared.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 42, Parliament Street, WESTMINSTER. [Office of the JOURNAL OF GAS LIGHTING, &c.]

EDGE'S PATENT
FOR REMOVING THE
CARBONACEOUS INCRUSTATION FROM GAS-RETORTS.

"Gas-Works, Stafford, Oct. 24, 1870.

"My dear Sir,—In reply to your favour just to hand, I have much pleasure in bearing my testimony to the efficiency of Edge's process for removing the carbon from Clay Retorts. It has been in use at these works during the last two years, and so satisfactorily has it done its work that I should be very sorry to be without it.—I remain, my dear sir, faithfully yours, "JOHN STOKER.

"E. Goddard, Esq."

For particulars and terms, apply to E. GODDARD, Sole Agent, Gas-Works, IPSWICH.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE
FIRE CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICK.

Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
Successors to
E. BAKER AND CO., LATE BRIERLEY HILL, STAFFORDSHIRE.

LIVESEY FIRE-CLAY WORKS,

NEAR BLACKBURN, LANCASHIRE.

(ESTABLISHED 1835.)

ORLANDO BROTHERS,

MANUFACTURER OF PATENT CLAY RETORTS,

AND EVERY DESCRIPTION OF

TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.

FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

As Trustees of the late ORLANDO BROTHERS, we most respectfully announce that we intend to continue the above business, under the name of ORLANDO BROTHERS, in which name all communications must be addressed.

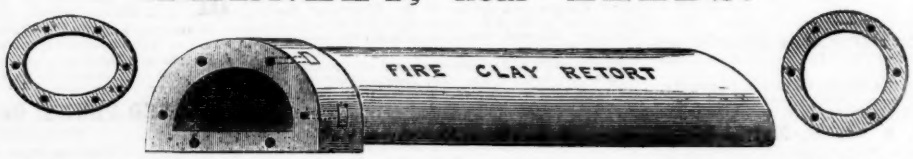
We trnst that we shall receive a continuance of the same support which was given to our late father.

We are, yours most respectfully,

ORLANDO BROTHERS.
FRANCIS W. BROTHERS.
COLIN BROTHERS.

THE FARNLEY IRON COMPANY, LIMITED,

FARNLEY, near LEEDS.



Since they so largely extended their Works, the F. I. Co. have experienced a most important increase in the demand for their Fire-Clay Retorts, which they owe chiefly to the superior quality of their make, and to the facilities they now possess for executing orders promptly, either for *home* or for *export*.

The Fire-Clay raised from the Farnley Estate (commonly called the Wortley bed) is unsurpassed by any other known in the district, and is peculiarly well adapted for Retorts, Gas-Ovens, and Fire-Bricks; and the F. I. Co. beg especially to invite those connected with Gas-Works, who have not yet used their Retorts, to be good enough to favour them with a trial.

The F. I. Co. generally hold in stock, for immediate supply, FIRE-BRICKS of every size and kind, White Facing Bricks, the White, Buff, and other GLAZED Bricks, in various colours and shapes, now extensively used for *Engine-houses*, Business Premises, as well as for Domestic and Public Buildings.

Prices, Drawings, and all other information may be obtained by applying *as above*; to the

Offices, 3, Westminster Chambers, Victoria Street, S.W.; or to F. Sutton, 46½, Queen Street, Hull.

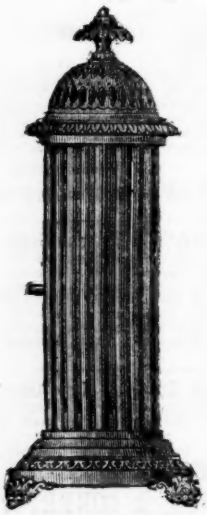
SCOTT AND BUTLER,

MANUFACTURERS OF

GAS-STOVES FOR WARMING, VENTILATING,

AND

DOMESTIC PURPOSES.



JONES'S PATENT.

IMPROVED GAS READING-LAMPS,

TERRA COTTA SMOKE CONSUMERS.

OPAL REFLECTORS.

TERRA COTTA BEEHIVE & GRECIAN STOVES.

ARGAND BURNERS.

SINGEING-LAMPS, &c.

SOLE MANUFACTURERS OF

JONES'S PATENT AND REGISTERED

HYGROMETRIC VENTILATING GAS-STOVE,

FOR

GREENHOUSES, BED-ROOMS, &c.

CUMBERLAND WORKS:

91 and 92, CONSTITUTION HILL, BIRMINGHAM.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

OXIDE OF IRON.—We are prepared to supply, on moderate terms, HYDRATED PEROXIDE OF IRON (BOG OCHRE), Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.

FRANCIS RITCHIE & SONS, BELFAST.

Established 1811.

READY & SON,

BILSTON STREET BRASS FOUNDRY, WOLVERHAMPTON

MANUFACTURERS OF

SUN BURNERS, GAS CHANDELIERS, HALL LANTERNS, BRACKETS, PENDANTS, And every Description of GAS-FITTINGS, Including MEDIÆVAL FITTINGS FOR CHURCHES, &c.

Large Pattern-Books complete, with Book of Prices, 7s. 6d.

WATER-WORKS FITTINGS,

SLUICE-COCKS, FIRE-COCKS, METERS, STEAM FITTINGS,

GAS & HOT-WATER VALVES, &c.,

Of First-class Materials and Workmanship.

BECK & CO., Limited,

BRASSFOUNDERS & HYDRAULIC ENGINEERS,

GREAT SUFFOLK STREET, SOUTHWARK, S.E.

Illustrated Catalogues on application.

J. T. B. PORTER & CO.,

GAS ENGINEERS,

MANUFACTURERS AND CONTRACTORS FOR GAS-WORKS Of any extent at Home and Abroad,

GOWTS BRIDGE WORKS, LINCOLN, AND JOHN STREET, ADELPHI, LONDON, W.C.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

Station-Meters, Governors, Consumers Meters, Gas Lustres, Chandeliers, Brackets, &c., and every description of Gas-Fittings and Gas Apparatus.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c., &c.,

SCOTSWOOD FIRE-BRICK WORKS, NEAR BLAYDON-ON-TYNE.

LAMBERT BROTHERS, WALSALL.

ALPHA TUBE & FITTING WORKS

PARIS, 1867.

CLASSES 24 and 53.

WILLIAM SUGG,

GAS ENGINEER.

LONDON, 1862.

CLASSES 13 and 31.

PUBLIC LAMP GOVERNORS, LEVER COCKS, AND POLE LIGHTERS,

LAMP METERS AND BOXES.

LOWE'S JET PHOTOMETERS CAN NOW BE RATED TO 14 CANDLES.

VINCENT WORKS, VINCENT STREET, WESTMINSTER, S.W.

Established 1827.

WILLIAM & BENJAMIN COWAN,

WET & DRY GAS-METER MANUFACTURERS, BRASSFOUNDERS, &c.

STATION-METERS with PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, TEST GASHOLDERS, GAUGES, &c.

BUCCLEUCH STREET WORKS, EDINBURGH.

Sole Manufacturers of ESSON'S PATENT COMPENSATING GAS-METER,

AND OF

COWAN'S PATENT SIDE-VALVE GAS-METER,

All of which may be had with

NEWBIGGING and HINDLE'S "PATENT AIR-TIGHT INDEX-BOX,"

Of which W. & B. C. are the Sole Manufacturers.

W. & B. COWAN'S DRY GAS-METERS, in CAST-IRON CASES,

Possess a simplicity of construction and facility for repair greater than any yet produced, while the excellence of the material and workmanship, and accuracy of registration, cannot be surpassed. The superiority of their Dry Meters in Tin Cases is also well known, having stood the test of years.

PRICE LISTS ON APPLICATION.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,
CANNEL COAL MERCHANT,
HAYMARKET EDINBURGH.
Established 1840.

SWANWICK CANNEL.

The yield of this Cannel is liberal, the illuminating power large, and coke good.

For prices and terms, apply to

H. BOAM, 1, Darwin Terrace, DERBY.

INCE HALL CANNEL COAL.

LEE & JERDEIN,

COAL OWNERS AND MERCHANTS,

Sole Vendors of the Ince Hall Wigan Coal and Cannel.

Chief Office:

9, LANCASTER PLACE, STRAND, LONDON, W.C.

CANNEL COAL.—The West Yorkshire

Iron and Coal Company, Limited, beg to draw the attention of Gas Companies to their Cannel, of which the following is the analysis made by W. Huggon, Esq., F.C.S.:

Yield of gas per ton	10,296 cubic feet.
Illuminating power rather over	21 sperm candles.
Yield of coke per ton . . .	12 cwt.

The actual working, as reported by one of the largest gas companies in Yorkshire, gives results still more favourable, viz.—

Yield of gas	10,416 cubic feet.
Illuminating power	21·89 sperm candles.
Coke	The same.

We add from the same source the capabilities of the common gas coal—

Yield of gas	10,080 cubic feet.
Illuminating power	14·41 sperm candles.
Yield of coke	13 cwt.

COLLIERIES—WEST ARDSLEY, near LEEDS.

For further particulars, address to the Office of the Company, 15, York Place, LEEDS.

POPE & PEARSON'S GAS COAL.—

We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles.*

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near LEEDS.

OLD WEMYSS CANNEL COAL.—

Yield of gas per ton, 12,896 cubic feet; illuminating power, 31·75 standard candles. Port of shipment, Wemyss.

Analysis and price on application to MR. WM. CAREY, Manager, Wemyss Colliery, Kirkcaldy, FIFE.

CANNEL COAL.

MESSRS. GRIFFITHS BROTHERS,

COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their Cannel for gas-making purposes.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to GRIFFITHS BROTHERS, Coppa Colliery, Mold, FLINTSHIRE.

THE

HUCKNALL COLLIERY COMPANY

Can offer a CANNEL COAL yielding a large quantity of Gas of superior quality.

Prices and information on application to the HUCKNALL COLLIERY COMPANY, Hucknall Torkard Collieries, near NOTTINGHAM.

FIRE-CLAY GAS-RETORTS, &c., CANNEL AND STEAM COALS.

WILLIAM FRASER, Inverkeithing

(owner of the Works at which Fire-Clay Retorts were first made), having greatly enlarged his Works, can supply RETORTS and other FIRE-CLAY GOODS to any extent.

References can be given to managers of above a hundred Gas-Works whom he supplies.

WILLIAM FRASER ships COWDENBEATH PARROT COALS at Charlestown and Burntisland at 11s. per ton; and HALBEATH STEAM COALS, on Navy List, at 7s. per ton.

BRONNER'S PATENT GAS-BURNERS

give 99 per cent. of light, as compared with 27 per cent. given by ordinary burners, with equal consumption of gas.—*Vide* "Gas Referees Report," published June, 1869.

HENRY GREENE AND SON, Sole Consignees of Brönner's Patent Improvements in Gas Lighting, 16 and 17, King William Street, E.C., and 138, Regent Street, LONDON. Agents wanted.

ROBERT MACLAREN and CO.,

EGLINTON FOUNDRY, GLASGOW,

Manufacturers of all sizes of Cast-Iron Main-Pipes by an improved Patent, General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

ADDISON POTTER,

WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,

Manufacturer of Clay Retorts, Fire-Bricks, and every description of Fire-Clay Goods.

SAM. CUTLER & SONS,

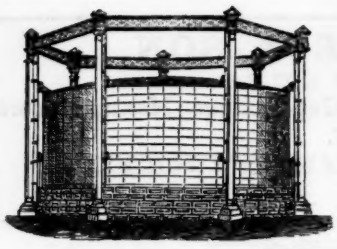
CONTRACTING GAS ENGINEERS,

GASHOLDER & GENERAL GAS APPARATUS MAKERS,

MANUFACTURERS OF

BOILERS, IRON ROOFING, IRON BRIDGES,

AND GENERAL IRONWORK.



S. C. AND SONS undertake Contracts of any magnitude for the **Erection of new and Remodelling of existing Gas-Works,** for **Gasholders, Cast and Wrought Iron Tanks, Iron Roofs,** and every description of **Apparatus** for the Manufacture and Distribution of Gas.

Special attention is invited to their **"Improved Condenser,"** which is very effective, and much approved; also to their patterns of **Annular** and other **Condensers, Scrubbers,** and **Purifiers,** of all sizes, which they arrange either with **Centre** or Ordinary **Slide Valves.**

WORKS FOR THE SUPPLY OF

VILLAGES, MANSIONS, FACTORIES, &c.

S. C. AND SONS undertake the **Supply** and **Laying of Mains** for **Gas and Water,** and supply all Castings, Connexions, and Fittings for Retort-House, Works generally, and for Streets. They also supply **Valves** of all descriptions, Iron and Clay Retorts, Hotpressed Retort-Lids, Steel Charging-Scoops of improved make, for which they have special machinery, Improved Coke and Coal Barrows, Cross-Bars and Screws, Bolts and Nuts, Furnace and Stoking Tools, Iron and Wood Purifier-Sieves, Lead, Yarn, Borings, &c., including every requisite whatsoever for a Gas-Work, a well-assorted stock being kept of those goods most in request.

SOLE MAKERS OF BRETT'S PATENT COKE BARROW.

Experienced Retort Setters sent to any part of the Kingdom.

Address: PROVIDENCE IRON-WORKS, MILLWALL, LONDON.

THE PATENT RIBBED GAS-RETORTS

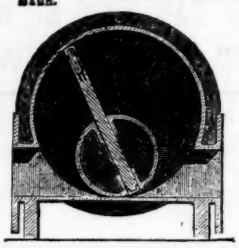
Are in Use at over 150 Gas-Works,

And continue to give entire satisfaction. Circulars, with prices and testimonials, will be sent on application to

A. C. FRASER, GAS-WORKS, MIDDLESBOROUGH.

TRADE MARK.

J. BEALE'S PATENT GAS EXHAUSTER.



BEALE'S CONTINUOUSLY ACTING

GAS EXHAUSTERS

ARE NOW MANUFACTURED BY

B. DONKIN & CO.

MR. J. BEALE, of East Greenwich, having retired from business, has made an arrangement with B. DONKIN & CO. for the sole manufacture of his Patent Solid-Slide Gas Exhausters.

B. D. & Co. also make Steam-Engines to drive Gas Exhausters direct or otherwise.

Estimates and Prices on application to

B. DONKIN & CO.,
ENGINEERS & IRONFOUNDERS,
BERMONDSEY, LONDON, S.E.

TO GAS COMPANIES AND THE TRADE.

J. DEFRIES & SONS,

MANUFACTURERS OF

CRYSTAL, BRONZED, & ORMOLU CHANDELIERS, IMPROVED CRYSTAL STAR & SUN LIGHTS, AND THE PATENT CRYSTAL ILLUMINATION;

Vestibules, Iron Barrel, Composition Tubing, Dry & Wet Meters, & Gas-Fittings

OF EVERY DESCRIPTION.

WORKS: LONDON, BIRMINGHAM, & PARIS.

REGISTERED DESIGNS.

Special Designs prepared in perfect accordance with architectural arrangements. Estimates furnished for the Lighting and Fitting up of Theatres, Music Halls, and Public or Private Building with Gas.

GAS MOONS of the newest designs.

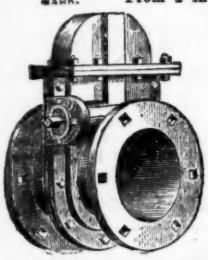
The Patent Gas-Regulator and Purifier reduced to 6s. 6d. per Doz.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1870, are now complete.

City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.

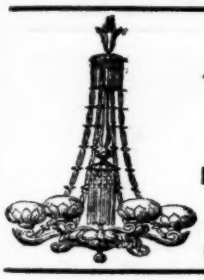
ESTABLISHED 1803.

REDUCED PRICES
OF
B. DONKIN & CO.'S
IMPROVED GAS-VALVES
WITH WROUGHT-IRON PINIONS,
From 2 inches to 18 inches, price 9s. 6d. to 12s. per inch diameter.



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.
These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.
VALVES MADE WITH OUTSIDE RACKS TO ORDER.
ALSO,
SCREW WATER-VALVES WITH GUN-METAL FACES.
B. DONKIN & CO.,
GENERAL ENGINEERS AND IRONFOUNDERS,
MAKERS OF STEAM-ENGINES,
BERMONDSEY, LONDON, S.E.

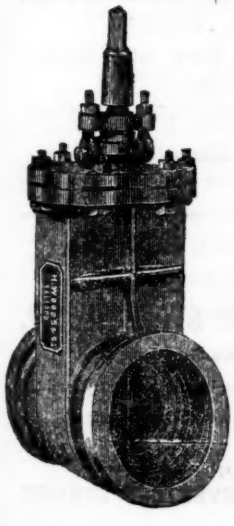
WALTER FORD,
159, GRAY'S INN ROAD, LONDON,
MANUFACTURER OF
WET & DRY GAS-METERS, STATION-METERS, GOVERNORS, &c.
SOLE MANUFACTURER OF
PADDON'S PATENT STREET-LAMP REGULATORS,
For ensuring any required consumption. These Regulators are in general and increasing use, and references can be given to Gas Companies who use them for every Lamp.



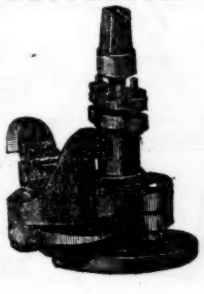
F. & C. OSLER,
45, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.
ESTABLISHED 1807.
MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.
TABLE GLASS OF ALL KINDS.
CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

GEORGE ANDERSON,
GAS AND CONSULTING ENGINEER,
19, NORTHUMBERLAND STREET, STRAND, W.C.
MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.
PATENTEE and MANUFACTURER of the following Inventions:—
RETORT SETTINGS, heated by tar without the production of smoke.
STEAM-ENGINES and EXHAUSTERS, separately or combined.
FOUR-WAY VALVES, one of which is equal to three ordinary Valves.
STATION GOVERNORS—the Gasholder cannot tilt and cause accident.
BREEZE AND TAR FUEL MACHINE.
A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.
N.B.—The second edition of this Work, *now ready*, contains illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.
"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artizan.*

HAMILTON WOODS AND CO.,
LIVER FOUNDRY, SALFORD,
MANUFACTURERS OF
SLUICE-VALVES & HYDRANTS,
As supplied to Water-Works and Local Boards.
SLUICE-VALVES, from 14s. per inch,
Tight on both Faces, and fitted with Gun-Metal Valve Faces and Seats, and Screws and Nuts.
Every Valve proved to 200 lbs. per square inch.
PRICE LISTS ON APPLICATION.

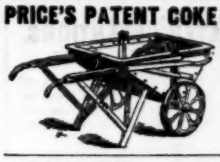


HYDRANTS,
WITH
Gun-Metal Screws,
Valves, and Nuts,
18s. each.



BALL
HYDRANTS,
84s. per doz.

PRICE'S PATENT COKE & COAL BARROW,



effecting a great saving of time, labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,
SUPPLY GAS & WATER PIPES of EVERY SIZE.
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
LONDON OFFICE: 95, CANNON STREET

BIRTLEY IRON WORKS,
CHESTER-LE-STREET,
DURHAM.
Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.
Agent in London, Mr. J. MANWARING, 101, Cann Street, E.C.

THOMAS LAMBERT & SONS,
SHORT STREET, LAMBETH, LONDON

PATENTEES OF THE
HIGH-PRESSURE EQUILIBRIUM BALL VALVES
AND DIAPHRAGM BIB & STOP VALVES,
MANUFACTURE EVERY DESCRIPTION OF
GAS-JOINTS, CHANDELIERS, PENDANTS, BRACKETS, ETC.;
WROUGHT-IRON
WELDED TUBE AND FITTINGS,
BLACK AND GALVANIZED;
BRASS, COPPER, LEAD, TIN, AND COMPOSITION TUBING,
STOCKS, TAPS, AND DIES,
And Every Description of Gas-Fitters Tools;
CAST-IRON GAS-MAIN COCKS,
WITH PATENT METAL PLUGS;
GAS SLIDE AND SLUICE VALVES;
CARTER'S SAFETY GAS-VALVES
GAS-STOVES, REGULATORS, BURNERS, &c.,
Large Pattern-Book and Price List of Gas-Fittings, price 7s. 6d., supplied on application.

JAMES NEWTON & SONS,
(Established 1820,)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.,
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY,
and every Article suitable for
GAS AND WATER WORKS.

WALTER MABON & CO.,
Engineers,
ARDWICK IRON-WORKS,
FAIRFIELD STREET, MANCHESTER,
MANUFACTURERS OF
IRON TANKS, GASHOLDERS,
GAS APPARATUS,
PIPES, VALVES, IRON ROOFS,
WROUGHT AND CAST IRON GIRDERS.
DESIGNS, SPECIFICATIONS, & ESTIMATES FURNISHED.

B. CARPENTER'S
IMPROVED
WOOD SIEVES FOR GAS PURIFIERS.
WORKS:
22, HERMES STREET, PENTONVILLE ROAD,
LONDON, N.
The above Sieves are used by the principal Gas Companies in London and the country. Their utility, durability, and cheapness combined, render them superior to all others.
Testimonials from Gas Engineers who have tested their qualities forwarded on application.
All orders punctually attended to, and estimates given if required.

INTERNATIONAL EXHIBITION, 1862.
CLASS X.
PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and
"HONOURABLE MENTION" for
good quality of Fire-Bricks.
WILLIAM STEPHENSON & SONS,
THROCKLEY,
NEWCASTLE-ON-TYNE.

Now publishing,

BAILEY'S ILLUSTRATED INVENTIONS,

With Illuminated Cover and over 300 Engravings.

Price 1s.

This book is replete with information, and prices of many well-known as well as perfectly new inventions, interesting to all in the mechanical trades, as well as corporations, governments, gas managers, private gentlemen, and shopkeepers.

Post free in the United Kingdom, 1s.

JOHN BAILEY AND Co., Albion Works, Salford, LANCASHIRE.

THOMAS PROUD,

GAS ENGINEER,

Invites attention to his

ALL-PLANED

WOOD GRIDS

FOR PURIFIERS,

And respectfully states that he has erected improved Steam Machinery for their manufacture, and devotes great care to supply Grids which will give satisfaction in quality and price.

He also solicits attention to his

IMPROVED GAUGE

which indicates pressure or vacuum in ONE TUBE. Having but one joint, the Gauge can be taken asunder, cleansed, and refixed in a few minutes.

Plans and estimates furnished for improvement of existing, or for the erection of new Gas-Works.

Sole Agent to

GEORGE SKEY & COMPANY,

Limited,

For FIRE-CLAY RETORTS.

Gas Apparatus Manufactory,

7, UNETT ST., ST. GEORGE'S,

BIRMINGHAM.

C. & W. WALKERS'

WOOD SIEVES FOR PURIFIERS.

These justly celebrated Sieves, with bevel bars and hard-wood side frames, have been extensively made by Messrs. Walker for over seven years, and their advantages and durability are fully established. Messrs. Walker make them in very large quantities, having mills and machinery specially laid out for them, producing them at the most moderate cost.

MIDLAND IRON-WORKS,

DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

8, FINSBURY CIRCUS, LONDON, E.C.

HANCOCK'S INDIA-RUBBER GAS-TUBING.

All sizes, from ¼ in. to 4 in. diameter and upwards.

Also,

HORSE SINGEING APPARATUS, best make, with GAS-BURNERS, COMBS, and INDIA-RUBBER TUBING, all complete.

INDIA-RUBBER BAGS for GAS-MAINS.

WASHERS for GAS and STEAM JOINTS.

VALVES (pure solid Rubber) for STEAM-ENGINES.

PACKING (Elastic) for STEAM-ENGINES.

FLANGE TUBING, for excluding Draughts and Dust through WINDOWS, DOORS, and GLASS CASES.

Section.

Illustrated Price Lists on application.

JAMES LYNE HANCOCK,

Vulcanized India-Rubber Works,

GOSWELL MEWS, AND 266, GOSWELL ROAD, LONDON, E.C.

THOMAS EDINGTON & SONS,

PHŒNIX IRON-WORKS,

GLASGOW,

MANUFACTURERS OF

GAS AND WATER PIPES,

All sizes up to 4 ft. diameter;

RAILWAY CHAIRS AND SLEEPERS, and general Castings. Also

GREGORY'S & COCKBURN-MUIR'S

PERMANENT WAY,

London Office: 63, OLD BROAD STREET, E.C.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 20 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including Iron Retorts, Socket and Flange Pipes, Bends, Branches, and Syphons of all sizes, Lamp Columns, &c., &c.

N.B.—Orders for Cast-Iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention. CHARLES HORSLEY, Agent.

Now ready, demy 8vo, half bound roan, cloth sides, lettered, price 7s. 6d., by post 8s.,

THE GAS MANAGER'S HANDBOOK,

CONSISTING OF

TABLES, RULES, AND USEFUL INFORMATION

FOR

GAS ENGINEERS, MANAGERS,

AND OTHERS ENGAGED IN THE

MANUFACTURE AND DISTRIBUTION OF COAL GAS.

By THOMAS NEWBIGGING A.I.C.E.

"The class of books to which the one we notice belongs is among the most useful that issues from the press; and this one, from the variety and amount of information it contains, may be fairly described as one of the most useful of its class. It is a book which will be thoroughly appreciated by those who until now have had to seek in a dozen volumes for the information here collected into one, and who have had to spend hours in making calculations here done to their hands."—*Mechanics' Magazine.*

WILLIAM B. KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Just published, Price Five Shillings,

A CHECK SYSTEM OF BOOK-KEEPING FOR GAS COMPANIES,

Ensuring the best possible check on the Gas-Rental and the Sales. The Expenditure Divisions adapted to the Board of Trade form for London Companies. A new and complete form for Manager's Station-Meter Book and Weekly Returns.

By CHARLES HIGHT, *Public Accountant*, 26, BUDGE ROW, LONDON, E.C.

Published by NISSEN, PARKER, AND ARNOLD, Mark Lane, LONDON, E.C., by whom the Account-Books will be supplied.

GAS COMPANIES ACCOUNTS AUDITED

Or Projected on moderate terms.

Country Gas Companies Accounts adapted to his own plan on specially moderate terms,

By C. HIGHT, Accountant & Auditor, 26, Budge Row, London, E.C.

SCHOLL'S

PATENT PLATINUM

GASLIGHT PERFECTER.

Extract from Report by Dr. Letheby:—

"The results have been very remarkable, for they show an average increase of 63 per cent. on the illuminating power of the gas. I am of opinion, therefore, that the invention is of great practical value."

Extract from Dr. Frankland's Course of Lectures at the Royal School of Mines, February, 1868.

"Scholl's Platinum Perfecter is one of the most important inventions of modern times in connexion with the burning of coal gas."

Price 1s. each for Fishtail Burners.

To be had retail of Gas-Fitters and Ironmongers.

JOHN SCHOLL, Manufactory: 41 & 42, BERWICK STREET;

Retail Depot: 198a, OXFORD STREET, LONDON, W.

Terms on application. N.B.—A specimen sent free on receipt of Twelve stamps.

*** Further testimonials from Drs. Frankland and Crooks, showing the great practical value of this invention, will be shortly published.

TO GAS COMPANIES, ENGINEERS, BUILDERS, &c.

THE PATENT ANTI-GALVANIC PAINT

Is guaranteed to prevent and arrest Rust on all Ironwork, and to cover Tar most effectually. It is most valuable for protecting it from the action of salt water, rain, sulphurous and gaseous exhalations. It has been well tested at various Gas-Works, in covering Tar on Gasholders, Purifiers, &c., and has given great satisfaction.

Testimonials given if required, and sample cans for trial sent free of charge.

All communications to be addressed to

Messrs. STEVENS & CO., 156, CHEAPSIDE, LONDON.

WILLEY & FORD,

GAS ENGINEERING WORKS, EXETER,

CONTRACTORS FOR THE ERECTION OF GAS-WORKS,

MANUFACTURERS OF IMPROVED WET & DRY METERS;

Also, EVERY DESCRIPTION OF GAS APPARATUS,

Comprising GASHOLDERS, STATION-METERS, GOVERNORS, CONDENSERS, PURIFIERS, RETORTS, SLIDE-VALVES, and every article appertaining to Gas-Works.

Gas Companies advised on Improvements, Extensions, and Alteration of Works.

*** The very best material and workmanship guaranteed, and at prices bearing a favourable comparison with any House in the Kingdom.

GAS COMPANIES & LOCAL BOARDS

Requiring New Street-Lamps are recommended

KEEN'S PATENT DOUBLE-CLIP STREET-LAMP.

A great improvement on the old-fashioned 14-in. Lamps.

They have been sold to various Gas-Works throughout the country, and the highest satisfactory testimonials are given as to their superiority.

For particulars of price, &c., apply to

EDWARD JEEVES, Manufacturer, WEYBRIDGE, SURREY.

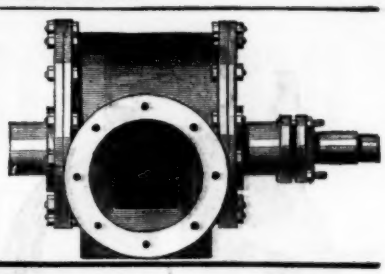
ROTATORY AND DOUBLE-ACTING GAS-EXHAUSTERS,

With many recent improvements, from 1500 to 150,000 cubic feet per Hour.

JAMES BURTON, SONS, & WALLER,

MAKERS OF ENGINES, MACHINERY, and IRONWORK for GAS-WORKS,
Efficient and durable TAR, LIQUOR, and SYPHON PUMPS,
GAS-VALVES, with or without Wedges, worked with powerful Worm and Rack,
SELF-ACTING BY-PASS VALVES, with Lid and Relieving Lever,
ROTATORY, TUMBLER, and CAPILLARY WATER DISTRIBUTORS for SCRUBBERS.
SMALL-SIZE EXHAUSTERS KEPT IN STOCK.

JOHN'S PLACE, HOLLAND STREET, SOUTHWARK, LONDON, S.E.



KING BROTHERS,

STOURBRIDGE FIRE-BRICK AND RETORT WORKS.

KING BROTHERS beg especially to call the attention of Gas Companies to the superiority of their Retorts, which are made from the celebrated STOURBRIDGE FIRE-CLAY. Mr. King has patented a Kiln for burning Retorts, by which Patent all Cold Air is excluded from the Kiln while burning, thus rendering them FREE FROM CRACKS AND CORRECT IN FORM. By great care in Manufacturing, combined with the advantages in burning, a VERY SMOOTH SURFACE is obtained, rendering them less liable to carbonize.

Retort Ovens, Fire-Bricks, Guards, Saddles, Rabbitted Bars, Flues, and Quarries, are all Manufactured of the same quality of Clay.

Every Retort and Brick is branded "King Brothers, Stourbridge."

Agent in Ireland—Mr. JAMES FURNESS, No. 3, FOWNES STREET, DUBLIN.

GEORGE NEWTON,

UNION STREET WEST, OLDHAM,

MANUFACTURER OF

IMPROVED WET & DRY CONSUMERS GAS-METERS,

GAS STATION-METERS,

With all the Joints planed,

GOVERNORS, GAUGES, INDICATORS, EXHAUST GOVERNORS, &c.

TERMS, &c., ON APPLICATION.

Established

1795.

JOSEPH CLIFF & SON,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

FIRE GOODS, and Salt-Glazed Drain-Pipes.

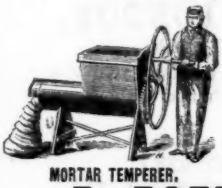
LONDON AGENT:

MARCUS BOURNE NEWTON,

Wharf No. 4, inside Great Northern Goods Station, King's Cross, N.

Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

FIRST PRIZE ROYAL AGRICULTURAL SHOW, 1869.



MORTAR TEMPERER.

GAS TAR & STREET WATER CART.

ALSO,
22 OTHER PRIZES
FOR
LIQUID MANURE CART
AND
PUMP.

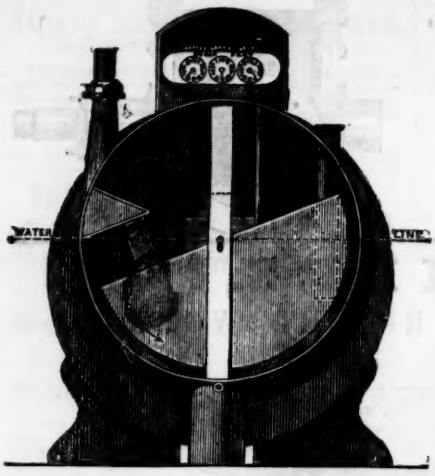
A FIRST PRIZE
BONE or STONE CRUSHER
FOR
HAND or POWER.

I. JAMES, TIVOLI WORKS, CHELTENHAM.

GAS AND WATER PIPES.

CLARIDGE, NORTH, & CO.,

BILSTON.



THE

UNVARYING WATER-LINE GAS-METER.

(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."

Over 60,000 in action.

MANUFACTURERS:

THE GAS-METER COMPANY,

KINGSLAND ROAD, LONDON;

WITH

Branch Manufactories at DUBLIN and OLDHAM.

ALEXANDER WRIGHT & CO.,

55 and 55A, MILLBANK STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

COMPENSATING & OTHER WET & IMPROVED DRY GAS-METERS,

Of the best material and workmanship, carefully adjusted to meet the requirements of the SALES OF GAS ACT.

STATION-METERS & GOVERNORS,

WRIGHT'S REGISTERING PRESSURE-GAUGE, EXHAUSTER REGISTER, AND REGULATOR;

STANDARD TEST GASHOLDERS;

Consumers' Governors; Inspectors' Pocket, King's, and all other kinds of Pressure-Gauges; Thermometers for Condensers, Pressure Registers, &c., &c.

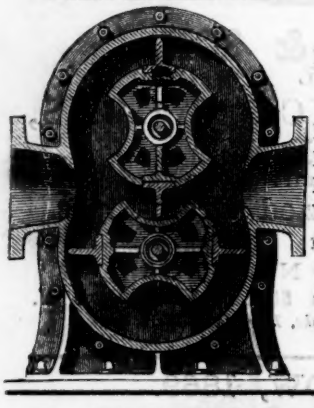
STANDARD PHOTOMETRIC AND OTHER TESTING APPARATUS,

Employed by the best experimenters in this country and on the Continent, and by the Gas Testers in the London districts.

STREET-LAMP REGULATORS OF THE BEST CONSTRUCTION,

Adjusted to any desired consumption.

LAIDLAW'S PATENT GAS EXHAUSTER.



R. LAIDLAW & SON,

GAS ENGINEERS, CONTRACTORS, IRON & BRASS FOUNDERS,

Iron-Works and Foundries, GLASGOW,

Meter-Works & Brass Foundry, EDINBURGH,

Manufacturers of GASOMETERS & GAS APPARATUS of EVERY DESCRIPTION; CAST-IRON PIPES, all sizes, cast in DRY SAND and VERTICALLY by PATENT MACHINERY; IRON ROOFS, COLUMNS, BEAMS, & GIRDERS; BOILERS, TANKS, & CISTERNS; VALVES, Screw, Rack and Pinion, &c., for Gas and Water, with Iron or Gun-Metal Facings, &c.; WROUGHT-IRON TUBE and FITTINGS for Gas, Water, or Steam; GAS-METERS (Wet and Dry) of the most approved Construction, STATION-METERS, GOVERNORS, &c.; GASELIERS, BRACKETS, PENDANTS, PILLARS, & GAS-FITTINGS of every description; LAMP-POSTS and LANTERNS for Streets, &c.

London Address: 106, CANNON STREET, E.C.

D. HULETT and CO., 55 and 56, HIGH HOLBORN, LONDON,

PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR,

Invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

MANUFACTURERS

GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;

DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;

IMPROVED FULL-WAY CARTER'S VALVES (much approved of);

GAS-STOVES, and every article connected with Gas Apparatus.

CAST & WROUGHT IRON PIPE, BLACK & GALVANIZED. COPPER, TIN, BRASS, & COMPOSITION TUBING.

D. HULETT'S IMPROVED SERVICE CLEANSER

for clearing out Mains, Services, and Interior Fittings—65s. net.

Boyle's Patent Silvered Glass Combination Reflectors and Outside Lanterns

Sole Manufacturers of Church and Mann's Photometer.

Large Pattern-Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s.

London: Printed by WILLIAM BOUGHTON KING (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street); and published by him at No. 11 Bolt Court Fleet Street, in the City of London.—Tuesday, January 31, 1871.